PBEEEP
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Public Buildings Enhanced Energy Efficiency Program

Investigation Results For
Southwest Minnesota State University Part 2

Minnesota STATE COLLEGES & UNIVERSITIES

SOUTHWEST MINNESOTA STATE UNIVERSITY

4/30/2012

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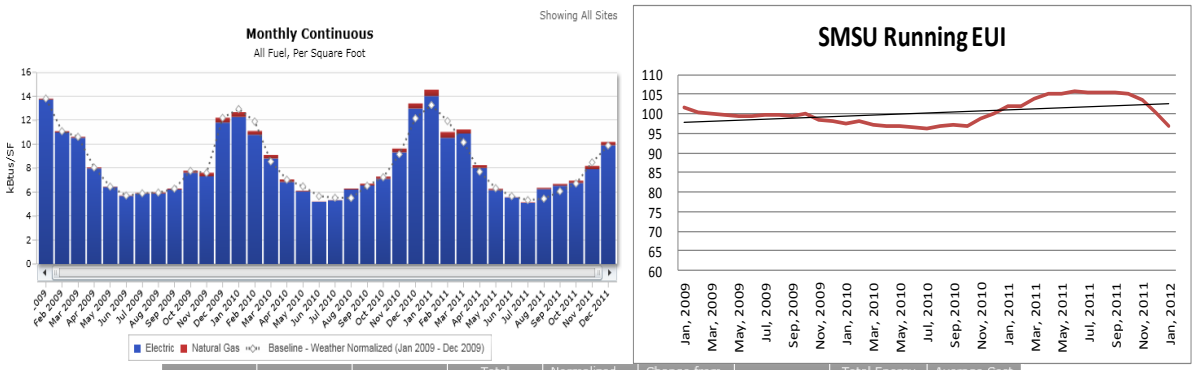
Investigation Overview

The goal of a PBEEEP Energy Investigation is to identify energy savings opportunities with a payback of fifteen years or less. Particular emphasis is on finding those opportunities that will generate savings with a relatively fast (1 to 5 years) and certain payback. During the investigation phase the provider conducts a rigorous analysis of the building operations. Through observation, targeted functional testing, and analysis of extensive trend and portable logger data, the RCx Provider identifies deficiencies in the operation of the mechanical equipment, lighting, envelope, and related controls. The investigation of the Southwest Minnesota State University, Part 2 was performed by Sebesta Blomberg & Associates, Inc. This report is the result of that information.

Payback Information and Energy Savings				
Total Project costs (Without Co-funding)			**Project costs with Co-funding**	
Total costs to date including study	$64,379		Total Project Cost	$151,164
Future costs including Implementation , Measurement & Verification	$86,785		Study and Administrative Cost Paid with ARRA Funds	($64,379)
Total Project Cost	$151,164		ARRA Funds for Lighting	($14,860)
			Total costs after co-funding	$71,925
Estimated Annual Total Savings ($)	$63,825		Estimated Annual Total Savings ($)	$63,825
Total Project Payback (years)	2.4		Total Project Payback (years) with co-funding	1.1
Electric Energy Savings	**27 %**	**and**	**Natural Gas Savings**	**1.8 %**
(Savings percentages are based on buildings in this project)				



Year	Days	SF	Total kBtu	Normalized Baseline kBtu	Change from Baseline kBtu	% Change	Total Energy Cost $	Average Cost Rate $ /kBtu
2009	365	1,193,036*	120,751,803	120,751,803	0	0%	$1,114,942.18	$0.01
2010	365	1,232,469	123,271,567	121,675,887	1,595,681	1%	$1,274,022.51	$0.01
2011	365	1,232,469	123,731,153	119,596,855	4,134,298	3%	$1,296,591.29	$0.01

Southwest MN State University Consumption Report

Summary Tables

Facility Name	Southwest Minnesota State University
Location	1501 State Street, Marshall, MN
Facility Manager	Cynthia Holm
Number of Buildings Investigated	4
Interior Square Footage Investigated	227,920
PBEEEP Provider	Sebesta, Blomberg, Inc.
Study Period	Summer 2011 – Winter 2012
Site Project Manager	Cynthia Holm
Annual Energy Cost	$1,296,591 (2011)
Utility Company	Western Area Power Association for Electric Great Plains Natural Gas Company for Natural Gas
Site Energy Use Index (EUI)	97 kBtu/sq. ft (at end of study from B3)
Benchmark EUI (from B3)	142 kBtu/sq. ft

Buildings Investigated:

The four buildings listed below totaling 227,920 interior square feet at SMSU were investigated.

Building Name	State ID	Area (Square Feet)	Year Built
Individualized Learning	E26075S0872	61,560	1972
Regional Event Center	E26075S8009	24,700	2008
Science & Math	E26075S0772	74,060	1972
Sweetland Hall	E26075S8010	67,600	2009

None of the buildings are sub-metered or metered individually.

Mechanical Equipment Summary Table	
1	Johnson Controls Metasys 4 Automation System
13	Air Handlers
90	Terminal Units
8	Exhaust Fans
2	Heat Recovery Units
1	Electric Hot Water Boilers
2	Natural Gas Hot Water Boiler
535	Points Available for Trending
400	Minimum Points to Trend
30	Terminal Units where data loggers are needed to gather data not on BAS

Implementation Information			
Estimated Annual Total Savings ($)			$63,285
Total Estimated Implementation Cost ($)			$83,785
GHG Avoided in U.S Tons (CO2e) (assuming standard electric generation in Minnesota, not WAPA's actual delivery)			405
Electric Energy Savings (kWh) (2011 Usage 6,522,600 kWh)*	27 % Savings		1,788,179
Electric Demand Savings (Peak kW) (2010 Peak demand was 1,631 kW)*	13.5 % Savings		219
Natural Gas Savings (Therms) (2010 Usage 33,874 Therms)	1.8 % Savings		598
Statistics			
Number of Measures identified			16
Number of Measures with payback < 3 years			7
Screening Start Date	03/21/2010	Screening End Date	05/19/2010
Investigation Start Date	08/01/2011	Investigation End Date	2/15/2012
Final Report	4/30/2012	Report Presentation	

*Prorated based on building area which is 18.5% of total campus

Southwest Minnesota State Part 2 Cost Information			
Phase		**To date**	**Estimated**
Screening			
Investigation [Provider]		$54,700	
Investigation [CEE]		$9,679	$1,000
Implementation			$83,785
Implementation [CEE]			$1,000
Measurement & Verification			$1,000
Total		$64,379	$86,785

Co-funding Summary	
Study and Administrative Cost	$64,379
ARRA Funds for 25% of Lighting ($)	$14,860
Total Co-funding ($)	$79,239

SMSU Overview

The energy investigation of four buildings that make up 18.5% of the building area at Southwest Minnesota State University identified 24% of energy savings in these buildings with measures that payback in less than 15 years and do not adversely affect occupant comfort. The energy savings opportunities identified at Southwest Minnesota State University include adjusting air handler operations to bring in less outside air when spaces are not occupied, utilizing night set backs, and replacing T-12 lighting with more efficient T-8 lighting. The total cost of implementing all the measures is $83,785.

Implementing all these measures can save the facility approximately $63,825 a year, paying back the cost of implementation by energy savings in 1.3 years. Because the study was paid for with ARRA funds the payback is based only on the implementation costs (the study cost is excluded). After a 25% grant of ARRA funds to pay for lighting upgrades, the implementation cost is reduced to $71,925 a 1.1 year payback.

During the period of the PBEEEP investigation energy use at Southwest Minnesota State University increased by about 3% compared to the year prior to the study. Implementing the measures identified here will allow SMSU a period of growth without increasing its overall energy consumption. It is now 32% below the benchmark value according to the Minnesota Benchmarking and Beyond database (B3).

The site is made up of twenty-six buildings totaling 1,229,932 interior square feet. There is a single automation system (Johnson Controls Metasys) which controls all the air handling and central plant equipment on the campus. The controls are DDC, but the actuation is mostly pneumatic. Some equipment is only monitored from the BAS. The buildings were all constructed between 1967 and 2009. There have been some major mechanical upgrades during the history of the facility but largely the equipment is original to the buildings. All of the campus is heated, but only twelve of the buildings are cooled.

The school operates year round, but with greatly reduced enrollment during the summer. The Western Area Power Association (WAPA, a federal power agency that distributes hydroelectric power) provides electricity to the campus through one meter and limits the demand the campus can use. During the summer months, the limit is 5MW, and during the winter, it is 10MW. If the campus goes over the limit, they must buy demand and energy from the open market, which is more expensive than WAPA. The campus is almost entirely on electric energy, only Sweetland Hall has natural gas equipment. There are two electric meters and four natural gas meters at SMSU. None of the buildings are sub-metered or metered individually.

The energy investigation included 4 buildings that had major construction projects underway during the period of the first energy investigation. Overall SMSU has the opportunity to save over 6 million kWh a year, or 16.7% of its current energy use as the result of the two PBEEEP investigations.

Findings Summary

Site: Southwest Minnesota State University Phase 2

Eco #	Building	Investigation Finding	Total Cost	Savings	Payback	Co-Funding	Payback Co-Funding	GHG
1	Individualized Learning	Less than Optimal Setpoints/Setbacks - Individualized Learning	$800	$23,150	0.03	$0	0.03	147
1	Science and Math	Less than Optimal Setpoints and no Night Setbacks - Science and Math Whole Building	$800	$21,369	0.04	$0	0.04	136
2	Individualized Learning	Over Ventilating - Heating Conditions - Individualized Learning AHU-2, 3, 4 and 5	$400	$4,556	0.09	$0	0.09	29
2	Science and Math	Over Ventilating - Heating Conditions - AHU-3, 4 and 6	$400	$1,901	0.21	$0	0.21	12
1	Sweetland Hall	Modify Setpoints and Unoccupied Setback Temperatures - Sweetland Hall Dorm Rooms	$680	$786	0.87	$0	0.87	5
4	Individualized Learning	Stuck Cooling Valve - AHU-3	$3,130	$2,036	1.54	$0	1.54	13
3	Science and Math	Poor Economizer Control - Science and Math AHU-3, 4, 6 and 7	$540	$346	1.56	$0	1.56	2
5	Science and Math	Faultly Control Valves - Science and Math AHU-3, 6 and 7	$3,980	$1,121	3.55	$0	3.55	7
1	Regional Event Center	Less than Optimal Setpoints and no Summer Cooling Temperature Setbacks - Regional Events Center Fan	$780	$176	4.42	$0	4.42	1
5	Individualized Learning	Inefficient Lighting Fixtures - Individualized Learning	$24,697	$4,122	5.99	$0	5.99	26
4	Science and Math	Low Efficiency Motors - Science and Math AHU-3, 4 and 7	$5,445	$575	9.46	$0	9.46	4
3	Individualized Learning	Low Efficiency Motors - AHU-3, 4 and 5	$3,655	$371	9.85	$0	9.85	2
6	Science and Math	Inefficient Lighting Fixtures - Science and Math Whole Building	$37,743	$3,314	11.39	$0	11.39	21
6	Individualized Learning	Poorly Tuned Cooling Valve - AHU-5	$140	$0	0.00	$0	0.00	0
7	Individualized Learning	Poorly Tuned Cooling Valve - CHW Loop C	$140	$0	0.00	$0	0.00	0
2	Regional Event Center	Poor Airflow Balancing - REC FCU-A101 and A102	$560	$0	0.00	$0	0.00	0

PBEEEP was made possible with funding from the U.S. Department of Energy and the MN Department of Commerce.

Findings Summary

Site: Southwest Minnesota State University Phase 2

Eco #	Building	Investigation Finding	Total Cost	Savings	Payback	Co-Funding	Payback Co-Funding	GHG
7	Science and Math	Poor Damper Modulation - Science and Math AHU-4	$140	$0	0.00	$0	0.00	0
2	Sweetland Hall	Excessive Heating	$35	$0	0.00	$0	0.00	0
		Total for Findings with Payback 3 years or less:	**$6,750**	**$54,144**	**0.12**	**$0**	**0.12**	**344**
		Total for all Findings:	**$84,065**	**$63,825**	**1.32**	**$0**	**1.32**	**405**

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Finding Type Number	Finding Type	Relevant Findings (if any)	Looked for, Not found	Not relevant
a.1 (1)	Time of Day enabling is excessive	3		1
a.2 (2)	Equipment is enabled regardless of need, or such enabling is excessive	3		1
a.3 (3)	Lighting is on more hours than necessary.		3	1
a.4 (4)	OTHER_Equipment Scheduling/Enabling		3	1
b.1 (5)	Economizer Operation – Inadequate Free Cooling (Damper failed in minimum or	1	1	2
b.2 (6)	Over-Ventilation – Outside air damper failed in an open position. Minimum outside air		2	1
b.3 (7)	OTHER_Economizer/OA Loads	2		2
c.1 (8)	Simultaneous Heating and Cooling is present and excessive		3	1
c.2 (9)	Sensor/Thermostat needs calibration, relocation/shielding, and/or replacement		3	1
c.3 (10)	Controls "hunt" and/or need Loop Tuning or separation of heating/cooling setpoints	2	2	
c.4 (11)	OTHER_Controls		3	1
d.1 (12)	Daylighting controls or occupancy sensors need optimization.		2	1
d.2 (13)	Zone setpoint setup/setback are not implemented or are sub-optimal.	3	1	

d.3 (14)	Fan Speed Doesn't Vary Sufficiently	1	1	2
d.4 (15)	Pump Speed Doesn't Vary Sufficiently		4	
d.5 (16)	VAV Box Minimum Flow Setpoint is higher than necessary		2	2
d.6 (17)	Other_Controls (Setpoint Changes)	3	1	
e.1 (18)	HW Supply Temperature Reset is not implemented or is sub-optimal		1	3
e.2 (19)	CHW Supply Temperature Reset is not implemented or is sub-optimal			4
e.3 (20)	Supply Air Temperature Reset is not implemented or is sub-optimal		4	
e.4 ( )	Supply Duct Static Pressure Reset is not implemented or is sub-optimal		1	3
e.5 (21)	Condenser Water Temperature Reset is not implemented or is sub-optimal			4
e.6 (22)	Other_Controls (Reset Schedules)		2	2
f.1 (23)	Daylighting Control needs optimization—Spaces are Over-Lit		3	1
f.2 (24)	Pump Discharge Throttled		4	
f.3 (25)	Over-Pumping		4	
f.4 (26)	Equipment is oversized for load.		4	
f.5 (27)	OTHER_Equipment Efficiency/Load Reduction		4	
g.1 (28)	VFD Retrofit - Fans	1	1	1

g.2 (29)	VFD Retrofit - Pumps			4
g.3 (30)	VFD Retrofit - Motors (process)			4
g.4 (31)	OTHER_VFD		2	2
h.1 (32)	Retrofit - Motors	2		2
h.2 (33)	Retrofit - Chillers			4
h.3 (34)	Retrofit - Air Conditioners (Air Handling Units, Packaged Unitary Equipment)		2	2
h.4 (35)	Retrofit - Boilers			4
h.5 (36)	Retrofit - Packaged Gas fired heating			4
h.6 (37)	Retrofit - Heat Pumps			4
h.7 (38)	Retrofit - Equipment (custom)		1	3
h.8 (39)	Retrofit - Pumping distribution method		2	2
h.9 (40)	Retrofit - Energy/Heat Recovery		2	2
h.10 (41)	Retrofit - System (custom)		2	2
h.11 (42)	Retrofit - Efficient Lighting	2	1	1
h.12 (43)	Retrofit - Building Envelope		3	1
h.13 (44)	Retrofit - Alternative Energy		3	1

h.14 (45)	OTHER_Retrofit		3	1
i.1 (46)	Differed Maintenance from Recommended/Standard		4	
i.2 (47)	Impurity/Contamination		4	
i.3 ( )	Leaky/Stuck Damper		4	
i.4 ( )	Leaky/Stuck Valve	2	2	
i.5 (48)	OTHER_Maintenance	1	3	
j.1 (49)	OTHER	1	3	

Findings Glossary: Findings Examples

a.1 (1)	**Time of Day enabling is excessive**
	• HVAC running when building is unoccupied. Equipment schedule doesn't follow building occupancy • Optimum start-stop is not implemented • Controls in hand
a.2 (2)	**Equipment is enabled regardless of need, or such enabling is excessive**
	• Fan runs at 2" static pressure. Lowering pressure to 1.8" does not create comfort problem and the flow is per design. • Supply air temperature and pressure reset: cooling and heating
a.3 (3)	**Lighting is on more hours than necessary**
	• Lighting is on at night when the building is unoccupied • Photocells could be used to control exterior lighting • Lighting controls not calibrated/adjusted properly
a.4 (4)	**OTHER Equipment Scheduling and Enabling**
	• Please contact PBEEEP Project Engineer for approval
b.1 (5)	**Economizer Operation – Inadequate Free Cooling**
	• Economizer is locked out whenever mechanical cooling is enabled (non-integrated economizer) • Economizer linkage is broken • Economizer setpoints could be optimized • Plywood used as the outdoor air control • Damper failed in minimum or closed position
b.2 (6)	**Over-Ventilation**
	• Demand-based ventilation control has been disabled • Outside air damper failed in an open position • Minimum outside air fraction not set to design specifications or occupancy
b.3 (7)	**OTHER Economizer/Outside Air Loads**
	• Please contact PBEEEP Project Engineer for approval
c.1 (8)	**Simultaneous Heating and Cooling is present and excessive**
	• For a given zone, CHW and HW systems are unnecessarily on and running simultaneously • Different setpoints are used for two systems serving a common zone
c.2 (9)	**Sensor / Thermostat needs calibration, relocation / shielding, and/or replacement**
	• OAT temperature is reading 5 degrees high, resulting in loss of useful economizer operation • Zone sensors need to be relocated after tenant improvements • OAT sensor reads high in sunlight
c.3 (10)	**Controls "hunt" / need Loop Tuning or separation of heating/cooling setpoints**
	• CHW valve cycles open and closed • System needs loop tuning – it is cycling between heating and cooling
c.4 (11)	**OTHER Controls**
	• Please contact PBEEEP Project Engineer for approval
d.1 (12)	**Daylighting controls or occupancy sensors need optimization**
	• Existing controls are not functioning or overridden • Light sensors improperly placed or out of calibration
d.2 (13)	**Zone setpoint setup / setback are not implemented or are sub-optimal**
	• The cooling setpoint is 74 ºF 24 hours per day
d.3 (14)	**Fan Speed Doesn't Vary Sufficiently**
	• Fan runs at 2" static pressure. Lowering pressure to 1.8" does not create comfort problem and the flow is per design. • Supply air temperature and pressure reset: cooling and heating

d.4 (15)	**Pump Speed Doesn't Vary Sufficiently**
	• Pump runs at 15 PSI on peak day. Lowering pressure to 12 does not create comfort problem and the flow is per design. Low ΔT across the chiller during low load conditions.
d.5 (16)	**VAV Box Minimum Flow Setpoint is higher than necessary**
	• Boxes universally set at 40%, regardless of occupancy. Most boxes can have setpoints lowered and still meet minimum airflow requirements.
d.6 (17)	**Other Controls (Setpoint Changes)**
	• Please contact PBEEEP Project Engineer for approval
e.1 (18)	**HW Supply Temperature Reset is not implemented or is sub-optimal**
	• HW supply temperature is a constant 180 ºF. It should be reset based on demand, or decreased by a reset schedule as OAT increases. • DHW Setpoints are constant 24 hours per day
e.2 (19)	**CHW Supply Temperature Reset is not implemented or is sub-optimal**
	• CHW supply temperature is a constant 42 ºF. It could be reset, based on demand or ambient temperature.
e.3 (20)	**Supply Air Temperature Reset is not implemented or is sub-optimal**
	• The SAT is constant at 55 ºF. It could be reset to minimize reheat and maximize economizer cooling. The reset should ideally be based on demand (e.g., looking at zone box damper positions), but could also be reset based on OAT.
e.4 ( )	**Supply Duct Static Pressure Reset is not implemented or is suboptimal**
	• The Duct Static Pressure (DSP) is constant at 1.5" wc. It could be reset to minimize fan energy. The reset should ideally be based on demand (e.g. looking at zone box damper positions), but could also be reset based on OAT.
e.5 (21)	**Condenser Water Temperature Reset is not implemented or is sub-optimal**
	• CW temperature is constant leaving the tower at 85 ºF. The temperature should be reduced to minimize the total energy use of the chiller and tower. It may be worthwhile to reset based on load and ambient conditions.
e.6 (22)	**Other Controls (Reset Schedules)**
	• Please contact PBEEEP Project Engineer for approval
f.1 (23)	**Lighting system needs optimization - Spaces are overlit**
	• Lighting exceeds ASHRAE or IES standard levels for specific space types or tasks
f.2 (24)	**Pump Discharge Throttled**
	• The discharge valve for the CHW pump is 30% open. The valve should be opened and the impeller size reduced to provide the proper flow without throttling.
f.3 (25)	**Over-Pumping**
	• Only one CHW pump runs when one chiller is running. However, due to the reduced pressure drop in the common piping, the pump is providing much greater flow than needed.
f.4 (26)	**Equipment is oversized for load**
	• The equipment cycles unnecessarily • The peak load is much less than the installed equipment capacity

f.5 (27)	**OTHER Equipment Efficiency/Load Reduction**
	• Please contact PBEEEP Project Engineer for approval
g.1 (28)	**VFD Retrofit Fans**
	• Fan serves variable flow system, but does not have a VFD. • VFD is in override mode, and was found to be not modulating.
g.2 (29)	**VFD Retrofit - Pumps**
	• 3-way valves are used to maintain constant flow during low load periods. • Only one CHW pumps runs when one chiller is running. However, due to the reduced pressure drop in the common piping, the pump is providing much greater flow than needed.
g.3 (30)	**VFD Retrofit - Motors (process)**
	• Motor is constant speed and uses a variable pitch sheave to obtain speed control.
g.4 (31)	**OTHER VFD**
	• Please contact PBEEEP Project Engineer for approval
h.1 (32)	**Retrofit - Motors**
	• Efficiency of installed motor is much lower than efficiency of currently available motors
h.2 (33)	**Retrofit - Chillers**
	• Efficiency of installed chiller is much lower than efficiency of currently available chillers
h.3 (34)	**Retrofit - Air Conditioners (Air Handling Units, Packaged Unitary Equipment)**
	• Efficiency of installed air conditioner is much lower than efficiency of currently available air conditioners
h.4 (35)	**Retrofit - Boilers**
	• Efficiency of installed boiler is much lower than efficiency of currently available boilers
h.5 (36)	**Retrofit - Packaged Gas-fired heating**
	• Efficiency of installed heaters is much lower than efficiency of currently available heaters
h.6 (37)	**Retrofit - Heat Pumps**
	• Efficiency of installed heat pump is much lower than efficiency of currently available heat pumps
h.7 (38)	**Retrofit - Equipment (custom)**
	• Efficiency of installed equipment is much lower than efficiency of currently available equipment
h.8 (39)	**Retrofit - Pumping distribution method**
	• Current pumping distribution system is inefficient, and could be optimized. • Pump distribution loop can be converted from primary to primary-secondary)
h.9 (40)	**Retrofit - Energy / Heat Recovery**
	• Energy is not recouped from the exhaust air. • Identification of equipment with higher effectiveness than the current equipment.
h.10 (41)	**Retrofit - System (custom)**
	• Efficiency of installed system is much lower than efficiency of another type of system
h.11 (42)	**Retrofit - Efficient lighting**
	• Efficiency of installed lamps, ballasts or fixtures are much lower than efficiency of currently available lamps, ballasts or fixtures.

h.12 (43)	**Retrofit - Building Envelope**
	• Insulation is missing or insufficient • Window glazing is inadequate • Too much air leakage into / out of the building • Mechanical systems operate during unoccupied periods in extreme weather
h.13 (44)	**Retrofit - Alternative Energy**
	• Alternative energy strategies, such as passive/active solar, wind, ground sheltered construction or other alternative, can be incorporated into the building design
h.14 (45)	**OTHER Retrofit**
	• Please contact PBEEEP Project Engineer for approval
i.1 (46)	**Differed Maintenance from Recommended/Standard**
	• Differed maintenance that results in sub-optimal energy performance. • Examples: Scale buildup on heat exchanger, broken linkages to control actuator missing equipment components, etc.
i.2 (47)	**Impurity/Contamination**
	• Impurities or contamination of operating fluids that result in sub-optimal performance. Examples include lack of chemical treatment to hot/cold water systems that result in elevated levels of TDS which affect energy efficiency.
i.3 ( )	**Leaky/Stuck Damper**
	• The outside or return air damper on an AHU is leaking or is not modulating causing the energy use go up because of additional load to the central heating and/or cooling plant.
i.4 ( )	**Leaky/Stuck Valve**
	• The heating or cooling coil valve on an AHU is leaking or is not modulating causing the energy use go up because of additional load to the central heating and/or cooling plant.
i.5 (48)	**OTHER Maintenance**
	• Please contact PBEEEP Project Engineer for approval
j.1 (49)	**OTHER**
	• Please contact PBEEEP Project Engineer for approval

Findings Summary

Building: Individualized Learning
Site: Southwest Minnesota State University Phase 2

Eco #	Investigation Finding	Total Cost	Savings	Payback	Co-Funding	Payback Co-Funding	GHG
1	Less than Optimal Setpoints/Setbacks - Individualized Learning	$800	$23,150	0.03	$0	0.03	147
2	Over Ventilating - Heating Conditions - Individualized Learning AHU-2, 3, 4 and 5	$400	$4,556	0.09	$0	0.09	29
4	Stuck Cooling Valve - AHU-3	$3,130	$2,036	1.54	$0	1.54	13
5	Inefficient Lighting Fixtures - Individualized Learning	$24,697	$4,122	5.99	$0	5.99	26
3	Low Efficiency Motors - AHU-3, 4 and 5	$3,655	$371	9.85	$0	9.85	2
6	Poorly Tuned Cooling Valve - AHU-5	$140	$0	0.00	$0	0.00	0
7	Poorly Tuned Cooling Valve - CHW Loop C	$140	$0	0.00	$0	0.00	0
	Total for Findings with Payback 3 years or less:	**$4,330**	**$29,743**	**0.15**	**$0**	**0.15**	**189**
	Total for all Findings:	**$32,962**	**$34,236**	**0.96**	**$0**	**0.96**	**217**

PBEEEP was made possible with funding from the U.S. Department of Energy and the MN Department of Commerce.

Findings Details

Building: Individualized Learning

FWB Number:	10151	Eco Number:	1
Site:	Southwest Minnesota State University Phase 2	Date/Time Created:	4/25/2012

Investigation Finding:	Less than Optimal Setpoints/Setbacks - Individualized Learning	Date Identified:	1/1/2012
Description of Finding:	Air handling units and spaces served were found to have constant tempreature setpoints during all times during the year resulting in unnecessary heating and cooling. No night setbacks in place.		
Equipment or System(s):	AHU with heating and cooling	Finding Category:	Controls (Setpoint Changes)
Finding Type:	Zone setpoint setup/setback are not implemented or are sub-optimal		

Implementer:	Facilities Management/JCI	Benefits:	Cost savings resulting from reduced electric heating and chilled water demand.
Baseline Documentation Method:	Trending data showing consistant space temperatures during all seasons and no night setbacks. See 'IL - AHU-x Summer, Fall, December and January Trended Data' graphs showing setpoints and trends.		
Measure:	Reduce Heating Setpoints/Increase Cooling Setpoints		
Recommendation for Implementation:	Reduce heating setpoint to 70F from 72F and increase cooling from 72F to 74F - May vary slightly from unit to unit - Air handling units AHU-1, 2, 3, 4 ,5. Implement night setbacks of 64F heating and 80F cooling from 9pm to 5am during weekdays and all day on weekends on air handling units AHU-1, 2, 3, 4 ,5. During night setback fans, heating and cooling shall be disabled and building shall be assumed to maintain acceptable temps without.		
Evidence of Implementation Method:	Trending data showing updated space temperatures and appriate setback periods.		

Annual Electric Savings (kWh):	653,957	Peak Demand Savings (kWh):	24
Estimated Annual kWh Savings ($):	$23,150	Estimated Annual Demand Savings ($):	$0
Contractor Cost ($):	$560		
PBEEEP Provider Cost for Implementation Assistance ($):	$240		
Total Estimated Implementation Cost ($):	$800		

Estimated Annual Total Savings ($):	$23,150	Utility Co-Funding for kWh ($):	$0
Initial Simple Payback (years):	0.03	Utility Co-Funding for kW ($):	$0
Simple Payback w/ Utility Co-Funding (years):	0.03	Utility Co-Funding for therms ($):	$0
GHG Avoided in U.S. Tons (C02e):	147	Utility Co-Funding - Estimated Total ($):	$0

Current Project as Percentage of Total project			
Percent Savings (Costs basis)	36.3%	Percent of Implementation Costs:	1.0%

PBEEEP was made possible with funding from the U.S. Department of Energy and the MN Department of Commerce.

Findings Details

Building: Individualized Learning

FWB Number:	10151	Eco Number:	2
Site:	Southwest Minnesota State University Phase 2	Date/Time Created:	4/25/2012

Investigation Finding:	Over Ventilating - Heating Conditions - Individualized Learning AHU-2, 3, 4 and 5	Date Identified:	1/1/2012
Description of Finding:	Heating supply air setpoint of 60F in building AHU-2, 3, 4 and 5 results in OA damper modulating to higher than required levels.		
Equipment or System(s):	AHU with heating and cooling	Finding Category:	Economizer/Outside Air Loads
Finding Type:	Over-Ventilation - Outside air damper failed in an open position. Minimum outside air fraction not set to design specifications or occupancy.		

Implementer:	Facilities Management/JCI	Benefits:	Cost savings resulting from reduced electric heating.
Baseline Documentation Method:	Trending data showing OA dampers varying between 30-60% to maintain setpoint discharge air temperatures.		
Measure:	Increase Heating Discharge Air Setpoint - Individualized Learning AHU-2, 3, 4 and 5		
Recommendation for Implementation:	Increase DA temp setpoint to 65F during heating conditions on AHU-2, 3, 4 and 5		
Evidence of Implementation Method:	Trending data showing appriate damper function - units modulating dampers to maintain 65F at or above minimum damper position.		

Annual Electric Savings (kWh):	128,702	Peak Demand Savings (kWh):	7
Estimated Annual kWh Savings ($):	$4,556	Estimated Annual Demand Savings ($):	$0
Contractor Cost ($):	$280		
PBEEEP Provider Cost for Implementation Assistance ($):	$120		
Total Estimated Implementation Cost ($):	$400		

Estimated Annual Total Savings ($):	$4,556	Utility Co-Funding for kWh ($):	$0
Initial Simple Payback (years):	0.09	Utility Co-Funding for kW ($):	$0
Simple Payback w/ Utility Co-Funding (years):	0.09	Utility Co-Funding for therms ($):	$0
GHG Avoided in U.S. Tons (C02e):	29	Utility Co-Funding - Estimated Total ($):	$0

Current Project as Percentage of Total project			
Percent Savings (Costs basis)	7.1%	Percent of Implementation Costs:	0.5%

PBEEEP was made possible with funding from the U.S. Department of Energy and the MN Department of Commerce.

Findings Details

Building: Individualized Learning

FWB Number:	10151	Eco Number:	3
Site:	Southwest Minnesota State University Phase 2	Date/Time Created:	4/25/2012

Investigation Finding:	Low Efficiency Motors - AHU-3, 4 and 5	Date Identified:	1/1/2012
Description of Finding:	AHU-3 15HP supply fan motor is estimated at 80% efficient, AHU-4 7.5HP supply fan motor shows a nominal efficiency of 85.5%, AHU-5 7.5HP supply fan motor is estimated at 80% efficient.		
Equipment or System(s):	AHU with heating and cooling	Finding Category:	Retrofits
Finding Type:	Retrofit - Motors		

Implementer:	Facilities Management	Benefits:	Cost savings resulting from reduced electrical consumption.
Baseline Documentation Method:	Photographs "IL - AHU-3 Exisitng 15 HP Supply Motor 1 &2", "IL - AHU-4 Exisitng 7.5 HP Supply Motor" and "IL - AHU-5 Exisitng 7.5 HP Supply Motor"		
Measure:	Install Premium Efficiency Motors		
Recommendation for Implementation:	Replace AHU-3 15HP motor with new 93% efficient motor, replace AHU-4 7.5HP motor with new 91% efficient motor, replace AHU-5 7.5HP motor with new 91% efficient motor. Replace existing V-belts with new cogged type for 2% drive efficiency improvement (Cogged type already equipped on AHU-3).		
Evidence of Implementation Method:	Photograph		

Annual Electric Savings (kWh):	10,484	Peak Demand Savings (kWh):	5
Estimated Annual kWh Savings ($):	$371	Estimated Annual Demand Savings ($):	$0
Contractor Cost ($):	$3,175		
PBEEEP Provider Cost for Implementation Assistance ($):	$480		
Total Estimated Implementation Cost ($):	$3,655		

Estimated Annual Total Savings ($):	$371	Utility Co-Funding for kWh ($):	$0
Initial Simple Payback (years):	9.85	Utility Co-Funding for kW ($):	$0
Simple Payback w/ Utility Co-Funding (years):	9.85	Utility Co-Funding for therms ($):	$0
GHG Avoided in U.S. Tons (C02e):	2	Utility Co-Funding - Estimated Total ($):	$0

Current Project as Percentage of Total project			
Percent Savings (Costs basis)	0.6%	Percent of Implementation Costs:	4.3%

PBEEEP was made possible with funding from the U.S. Department of Energy and the MN Department of Commerce.

Findings Details

Building: Individualized Learning

FWB Number:	10151	Eco Number:	4
Site:	Southwest Minnesota State University Phase 2	Date/Time Created:	4/25/2012

Investigation Finding:	Stuck Cooling Valve - AHU-3	Date Identified:	1/1/2012
Description of Finding:	AHU-3 appears to be stuck open cause simultaneous heating and cooling		
Equipment or System(s):	AHU with heating and cooling	Finding Category:	Maintenance Related Problems
Finding Type:	Leaky/Stuck Valve		

Implementer:	Facilities Management/JCI	Benefits:	Proper unit operation and electric savings from eliminating excess heating.
Baseline Documentation Method:	Trends showing discharge air temperature lower than expected and unaffected by modulation of control valve. Supply appears to be cooled 3F when cooling valve should be closed. See 'IL - AHU-3 Stuck Cooling Valve Summer, Fall' for trending of non-responsive valve.		
Measure:	Replace Faulty Cooling Valve		
Recommendation for Implementation:	Replace AHU-3 cooling valve with equivalently sized valve.		
Evidence of Implementation Method:	Trending data showing proper discharge air temperature corresponding with valve position.		

Annual Electric Savings (kWh):	57,526	Contractor Cost ($):	$2,650
Estimated Annual kWh Savings ($):	$2,036	PBEEEP Provider Cost for Implementation Assistance ($):	$480
		Total Estimated Implementation Cost ($):	$3,130

Estimated Annual Total Savings ($):	$2,036	Utility Co-Funding for kWh ($):	$0
Initial Simple Payback (years):	1.54	Utility Co-Funding for kW ($):	$0
Simple Payback w/ Utility Co-Funding (years):	1.54	Utility Co-Funding for therms ($):	$0
GHG Avoided in U.S. Tons (C02e):	13	Utility Co-Funding - Estimated Total ($):	$0

Current Project as Percentage of Total project			
Percent Savings (Costs basis)	3.2%	Percent of Implementation Costs:	3.7%

PBEEEP was made possible with funding from the U.S. Department of Energy and the MN Department of Commerce.

Findings Details

Building: Individualized Learning

FWB Number:	10151	Eco Number:	5
Site:	Southwest Minnesota State University Phase 2	Date/Time Created:	4/25/2012

Investigation Finding:	Inefficient Lighting Fixtures - Individualized Learning	Date Identified:	1/1/2012
Description of Finding:	A total of 727 lighting fixtures were found on-site utilizing T-12 lamps. Estimated 2112 T-12 lamps used based on fixture specifications and on-site observations.		
Equipment or System(s):	Interior Lighting	Finding Category:	Retrofits
Finding Type:	Retrofit - Efficient Lighting		

Implementer:	Facilities Management/Contractor	Benefits:	Cost savings from reduced electric consumption.
Baseline Documentation Method:	Listing of existing fixtures counts and specifications noting fixture types.		
Measure:	Install T-8 Lighting		
Recommendation for Implementation:	Replace all T-12 fixtures with lower wattage T-8 equivalents. Estimated savings based on replacement of T-12 fixture with magnetic ballast to T-8 fixture with electronic ballast with an operation schedule of 12 hours per day / 235 days/year. Wattage savings per fixture from Xcel Energy Lighting Efficiency Input Wattage Guide.		
Evidence of Implementation Method:	N/A		

Annual Electric Savings (kWh):	116,447	Peak Demand Savings (kWh):	83
Estimated Annual kWh Savings ($):	$4,122	Estimated Annual Demand Savings ($):	$0
Contractor Cost ($):	$24,697		
PBEEEP Provider Cost for Implementation Assistance ($):	$0		
Total Estimated Implementation Cost ($):	$24,697		

Estimated Annual Total Savings ($):	$4,122	Utility Co-Funding for kWh ($):	$0
Initial Simple Payback (years):	5.99	Utility Co-Funding for kW ($):	$0
Simple Payback w/ Utility Co-Funding (years):	5.99	Utility Co-Funding for therms ($):	$0
GHG Avoided in U.S. Tons (C02e):	26	Utility Co-Funding - Estimated Total ($):	$0

Current Project as Percentage of Total project			
Percent Savings (Costs basis)	6.5%	Percent of Implementation Costs:	29.4%

PBEEEP was made possible with funding from the U.S. Department of Energy and the MN Department of Commerce.

Findings Details

Building: Individualized Learning

FWB Number:	10151	Eco Number:	6
Site:	Southwest Minnesota State University Phase 2	Date/Time Created:	4/25/2012

Investigation Finding:	Poorly Tuned Cooling Valve - AHU-5	Date Identified:	1/1/2012
Description of Finding:	Cooling valve is observed be over-modulating open and closed to maintain discharge air temperature beyond what is required resulting in a fluctuating discharge air temperature.		
Equipment or System(s):	AHU with heating and cooling	Finding Category:	Deleted
Finding Type:	Finding Deleted by PBEEEP		

Implementer:	JCI	Benefits:	Proper unit operation and elimination of 'hunting'.
Baseline Documentation Method:	Trending data "IL - AHU-5 Cooling Valve Hunting".		
Measure:	Refine Valve PID Loop Control - IL AHU-5		
Recommendation for Implementation:	Refine PID loop control to eliminate overcooling and undercooling discharge air.		
Evidence of Implementation Method:	Trending data showing consistant summer discharge air temperature.		

Contractor Cost ($):	$140
PBEEEP Provider Cost for Implementation Assistance ($):	$0
Total Estimated Implementation Cost ($):	$140

Estimated Annual Total Savings ($):	$0	Utility Co-Funding for kWh ($):	$0
Initial Simple Payback (years):	0.00	Utility Co-Funding for kW ($):	$0
Simple Payback w/ Utility Co-Funding (years):	0.00	Utility Co-Funding for therms ($):	$0
GHG Avoided in U.S. Tons (C02e):	0	Utility Co-Funding - Estimated Total ($):	$0

Current Project as Percentage of Total project			
Percent Savings (Costs basis)	0.0%	Percent of Implementation Costs:	0.2%

PBEEEP was made possible with funding from the U.S. Department of Energy and the MN Department of Commerce.

Findings Details

Building: Individualized Learning

FWB Number:	10151	Eco Number:	7
Site:	Southwest Minnesota State University Phase 2	Date/Time Created:	4/25/2012

Investigation Finding:	Poorly Tuned Cooling Valve - CHW Loop C	Date Identified:	1/1/2012
Description of Finding:	Control valve is shown to modulated return water temperature in 'spikes' due to poor tuning of control valve.		
Equipment or System(s):	Pump, secondary CHW (distr-only or evap and distr)	Finding Category:	Deleted
Finding Type:	Finding Deleted by PBEEEP		

Implementer:	JCI	Benefits:	Proper unit operation and elimination of 'hunting'.
Baseline Documentation Method:	Trending data "IL - CHW Zone C.pdf".		
Measure:	Refine Valve PID Loop Control- IL CHW Pump C		
Recommendation for Implementation:	Refine PID loop control to eliminate spikes in CHWR temperature.		
Evidence of Implementation Method:	Trending data showing smoother valve operation during cooling season.		

Contractor Cost ($):	$140
PBEEEP Provider Cost for Implementation Assistance ($):	$0
Total Estimated Implementation Cost ($):	$140

Estimated Annual Total Savings ($):	$0	Utility Co-Funding for kWh ($):	$0
Initial Simple Payback (years):	0.00	Utility Co-Funding for kW ($):	$0
Simple Payback w/ Utility Co-Funding (years):	0.00	Utility Co-Funding for therms ($):	$0
GHG Avoided in U.S. Tons (C02e):	0	Utility Co-Funding - Estimated Total ($):	$0

Current Project as Percentage of Total project			
Percent Savings (Costs basis)	0.0%	Percent of Implementation Costs:	0.2%

PBEEEP was made possible with funding from the U.S. Department of Energy and the MN Department of Commerce.

Findings Summary

Building: Regional Event Center
Site: Southwest Minnesota State University Phase 2

Eco #	Investigation Finding	Total Cost	Savings	Payback	Co-Funding	Payback Co-Funding	GHG
1	Less than Optimal Setpoints and no Summer Cooling Temperature Setbacks - Regional Events Center Fan	$780	$176	4.42	$0	4.42	1
2	Poor Airflow Balancing - REC FCU-A101 and A102	$560	$0	0.00	$0	0.00	0
	Total for Findings with Payback 3 years or less:	**$0**	**$0**	**0.00**	**$0**	**0.00**	**0**
	Total for all Findings:	**$1,340**	**$176**	**7.60**	**$0**	**7.60**	**1**

Findings Details

Building: Regional Event Center

FWB Number:	10152	Eco Number:	1
Site:	Southwest Minnesota State University Phase 2	Date/Time Created:	4/24/2012

Investigation Finding:	Less than Optimal Setpoints and no Summer Cooling Temperature Setbacks - Regional Events Center Fan	Date Identified:	1/1/2012
Description of Finding:	Setpoints are currently 70F/72F heating/cooling. This temperature band appears to result in units hunting between heating in cooling at times to maintain setpoints. Additionally, units were not found to utilize temperature setbacks during cooling condititions. Winter setbacks were found to operate properly.		
Equipment or System(s):	AHU with heating and cooling	Finding Category:	Controls (Setpoint Changes)
Finding Type:	Zone setpoint setup/setback are not implemented or are sub-optimal		

Implementer:	Facilities Management/JCI	Benefits:	Cost savings from reduced chilled water demand.
Baseline Documentation Method:	Trending data indicating current setpoints, evidence of hunting, no cooling setbacks and properly functioning heating setbacks.		
Measure:	Increase Cooling Setpoints and Implement Cooling Setbacks - Regional Events Center Fan Coil Units		
Recommendation for Implementation:	Modify space temperature setpoints to 70F/74F heating/cooling and implement temperature setback of 80F during unoccupied cooling conditions.		
Evidence of Implementation Method:	Trending data showing updated cooling space temperature and proper unoccupied cooling setbacks.		

Annual Electric Savings (kWh):	4,980	Contractor Cost ($):	$500
Estimated Annual kWh Savings ($):	$176	PBEEEP Provider Cost for Implementation Assistance ($):	$280
		Total Estimated Implementation Cost ($):	$780

Estimated Annual Total Savings ($):	$176	Utility Co-Funding for kWh ($):	$0
Initial Simple Payback (years):	4.42	Utility Co-Funding for kW ($):	$0
Simple Payback w/ Utility Co-Funding (years):	4.42	Utility Co-Funding for therms ($):	$0
GHG Avoided in U.S. Tons (C02e):	1	Utility Co-Funding - Estimated Total ($):	$0

Current Project as Percentage of Total project			
Percent Savings (Costs basis)	0.3%	Percent of Implementation Costs:	0.9%

PBEEEP was made possible with funding from the U.S. Department of Energy and the MN Department of Commerce.

Findings Details

Building: Regional Event Center

FWB Number:	10152	Eco Number:	2
Site:	Southwest Minnesota State University Phase 2	Date/Time Created:	4/24/2012

Investigation Finding:	Poor Airflow Balancing - REC FCU-A101 and A102	Date Identified:	1/1/2012
Description of Finding:	FCU serves two zones for which the average temerature is used to determine demand. Zone temperures are averaging 5-10F apart.		
Equipment or System(s):	AHU with heating and cooling	Finding Category:	OTHER
Finding Type:	Other		

Implementer:	Facilities Management/HVAC Contractor	Benefits:	Improved Space Conditions.
Baseline Documentation Method:	Trending data indicating temperature differential between zones during heating and cooling seasons		
Measure:	Rebalance FCU Zones FCU-A101, A102.		
Recommendation for Implementation:	Rebalance zone airflows to CFMs noted on building plans. Increase airflow to zone showing under heating/cooling if plan CFMs are not adequate.		
Evidence of Implementation Method:	Trending data showing improved zone temperatures and control.		

Contractor Cost ($):	$560
PBEEEP Provider Cost for Implementation Assistance ($):	$0
Total Estimated Implementation Cost ($):	$560

Estimated Annual Total Savings ($):	$0	Utility Co-Funding for kWh ($):	$0
Initial Simple Payback (years):	0.00	Utility Co-Funding for kW ($):	$0
Simple Payback w/ Utility Co-Funding (years):	0.00	Utility Co-Funding for therms ($):	$0
GHG Avoided in U.S. Tons (C02e):	0	Utility Co-Funding - Estimated Total ($):	$0

Current Project as Percentage of Total project			
Percent Savings (Costs basis)	0.0%	Percent of Implementation Costs:	0.7%

PBEEEP was made possible with funding from the U.S. Department of Energy and the MN Department of Commerce.

Findings Summary

Building: Science and Math
Site: Southwest Minnesota State University Phase 2

Eco #	Investigation Finding	Total Cost	Savings	Payback	Co-Funding	Payback Co-Funding	GHG
1	Less than Optimal Setpoints and no Night Setbacks - Science and Math Whole Building	$800	$21,369	0.04	$0	0.04	136
2	Over Ventilating - Heating Conditions - AHU-3, 4 and 6	$400	$1,901	0.21	$0	0.21	12
3	Poor Economizer Control - Science and Math AHU-3, 4, 6 and 7	$540	$346	1.56	$0	1.56	2
5	Faultly Control Valves - Science and Math AHU-3, 6 and 7	$3,980	$1,121	3.55	$0	3.55	7
4	Low Efficiency Motors - Science and Math AHU-3, 4 and 7	$5,445	$575	9.46	$0	9.46	4
6	Inefficient Lighting Fixtures - Science and Math Whole Building	$37,743	$3,314	11.39	$0	11.39	21
7	Poor Damper Modulation - Science and Math AHU-4	$140	$0	0.00	$0	0.00	0
	Total for Findings with Payback 3 years or less:	**$1,740**	**$23,616**	**0.07**	**$0**	**0.07**	**150**
	Total for all Findings:	**$49,048**	**$28,627**	**1.71**	**$0**	**1.71**	**182**

PBEEEP was made possible with funding from the U.S. Department of Energy and the MN Department of Commerce.

Findings Details

Building: Science and Math

FWB Number:	10154	Eco Number:	1
Site:	Southwest Minnesota State University Phase 2	Date/Time Created:	4/25/2012

Investigation Finding:	Less than Optimal Setpoints and no Night Setbacks - Science and Math Whole Building	Date Identified:	1/1/2012
Description of Finding:	Air handling units and spaces served were found to have constant tempreature setpoints during all times during the year resulting in unnecessary heating and cooling. In addition, no night setbacks or unit cycling is in place resulting in units running far more than required.		
Equipment or System(s):	AHU with heating and cooling	Finding Category:	Controls (Setpoint Changes)
Finding Type:	Zone setpoint setup/setback are not implemented or are sub-optimal		

Implementer:	Facilities Management/JCI	Benefits:	Cost savings resulting from reduced electric heating and chilled water demand.
Baseline Documentation Method:	Trending data showing consistant space temperatures during all seasons and all times of the day and weekends.		
Measure:	Reduce Heating Setpoints/Increase Cooling Setpoints		
Recommendation for Implementation:	Reduce heating setpoint to 70F from 72F and increase cooling from 72F to 74F - May vary slightly from unit to unit - Air handling units AHU-2, 3, 4, 6 ,7. Implement night setbacks of 64F heating and 80F cooling from 9pm to 5am during weekdays and all day on weekends on air handling units AHU-2, 3, 4, 6 ,7. During night setback fans, heating and cooling shall be disabled and building shall be assumed to maintain acceptable temps without. If units are required to cycle on to maintain space setback temperature limit all outside air dampers shall be set to 0% during this time to eliminate unneccesary ventilation. Heating conditions shall be defined as periods of outdoor air below 55F.		
Evidence of Implementation Method:	Trending data showing updated space temperatures and appropriate setback periods for air handling units AHU-2, 3, 4, 6 and 7. Units should set back at all hours listed and not allow temperature to fall below setback temperatures.		

Annual Electric Savings (kWh):	603,635	Peak Demand Savings (kWh):	12
Estimated Annual kWh Savings ($):	$21,369	Estimated Annual Demand Savings ($):	$0
Contractor Cost ($):	$560		
PBEEEP Provider Cost for Implementation Assistance ($):	$240		
Total Estimated Implementation Cost ($):	$800		

Estimated Annual Total Savings ($):	$21,369	Utility Co-Funding for kWh ($):	$0
Initial Simple Payback (years):	0.04	Utility Co-Funding for kW ($):	$0
Simple Payback w/ Utility Co-Funding (years):	0.04	Utility Co-Funding for therms ($):	$0
GHG Avoided in U.S. Tons (C02e):	136	Utility Co-Funding - Estimated Total ($):	$0

Current Project as Percentage of Total project			
Percent Savings (Costs basis)	33.5%	Percent of Implementation Costs:	1.0%

PBEEEP was made possible with funding from the U.S. Department of Energy and the MN Department of Commerce.

Findings Details

PBEEEP State Government

Building: Science and Math

FWB Number:	10154	Eco Number:	2
Site:	Southwest Minnesota State University Phase 2	Date/Time Created:	4/25/2012

Investigation Finding:	Over Ventilating - Heating Conditions - AHU-3, 4 and 6	Date Identified:	1/1/2012
Description of Finding:	Heating supply air discharge setpoint of 60F in air handling units AHU-3, 4 and 6 results in OA damper modulating to higher than required levels.		
Equipment or System(s):	AHU with heating and cooling	Finding Category:	Economizer/Outside Air Loads
Finding Type:	Over-Ventilation - Outside air damper failed in an open position. Minimum outside air fraction not set to design specifications or occupancy.		

Implementer:	Facilities Management/JCI	Benefits:	Cost savings resulting from reduced electric heating.
Baseline Documentation Method:	Trending data showing OA damper varying between 30-60% to maintain setpoint discharge air temperatures.		
Measure:	Increase Heating Discharge Air Setpoint - Science and Math AHU-3, 4 and 6		
Recommendation for Implementation:	Increase DA temp setpoint to 65F during heating conditions on AHU-3, 4 and 6 during outdoor air conditions below 55F dry bulb. Discharge air setpoint is adjustable via JCI Metasys control computer interface.		
Evidence of Implementation Method:	Trending data showing appriate damper function - units modulating dampers to maintain 65F at or above minimum damper position.		

Annual Electric Savings (kWh):	53,706	Peak Demand Savings (kWh):	1
Estimated Annual kWh Savings ($):	$1,901	Estimated Annual Demand Savings ($):	$0
Contractor Cost ($):	$280		
PBEEEP Provider Cost for Implementation Assistance ($):	$120		
Total Estimated Implementation Cost ($):	$400		

Estimated Annual Total Savings ($):	$1,901	Utility Co-Funding for kWh ($):	$0
Initial Simple Payback (years):	0.21	Utility Co-Funding for kW ($):	$0
Simple Payback w/ Utility Co-Funding (years):	0.21	Utility Co-Funding for therms ($):	$0
GHG Avoided in U.S. Tons (C02e):	12	Utility Co-Funding - Estimated Total ($):	$0

Current Project as Percentage of Total project			
Percent Savings (Costs basis)	3.0%	Percent of Implementation Costs:	0.5%

PBEEEP was made possible with funding from the U.S. Department of Energy and the MN Department of Commerce.

Findings Details

PBEEEP State Government

Building: Science and Math

FWB Number:	10154	Eco Number:	3
Site:	Southwest Minnesota State University Phase 2	Date/Time Created:	4/25/2012

Investigation Finding:	Poor Economizer Control - Science and Math AHU-3, 4, 6 and 7	Date Identified:	1/1/2012
Description of Finding:	AHU-3: OA damper remains fixed at 10% during cooling conditions when full economizer would have been suitable to condition spaces. AHU-4, 6, 7: Economizers do not operate as expected, typically remain at minimum positions.		
Equipment or System(s):	AHU with heating and cooling	Finding Category:	Economizer/Outside Air Loads
Finding Type:	Other Economizer/OA Loads		

Implementer:	Facilities Management/JCI	Benefits:	Cost savings resulting from reduced chilled water demand.
Baseline Documentation Method:	Trending data showing minimal usage of economizer during appropriate conditions.		
Measure:	Improve Economizer Control Science and Math AHU-3, 4, 6 and 7		
Recommendation for Implementation:	Contractor shall investigate AHU economizer operation on AHU-3, 4, 6 and 7 to determine cause of poor utilization during cooling conditions. Although building automation system lists economizer high limit as 70F it was found that outdoor air dampers were set to minimimums during outdoor air temperatures of 55F to 70F. Configure economizer operation to run when OA temperature is lower than return air temperature between 55-70F.		
Evidence of Implementation Method:	Johnson Controls trended data for unit operation with outdoor air conditions between 55-70 showing full economizer operation and proper damper function.		

Annual Electric Savings (kWh):	9,775	Contractor Cost ($):	$420
Estimated Annual kWh Savings ($):	$346	PBEEEP Provider Cost for Implementation Assistance ($):	$120
		Total Estimated Implementation Cost ($):	$540

Estimated Annual Total Savings ($):	$346	Utility Co-Funding for kWh ($):	$0
Initial Simple Payback (years):	1.56	Utility Co-Funding for kW ($):	$0
Simple Payback w/ Utility Co-Funding (years):	1.56	Utility Co-Funding for therms ($):	$0
GHG Avoided in U.S. Tons (C02e):	2	Utility Co-Funding - Estimated Total ($):	$0

Current Project as Percentage of Total project			
Percent Savings (Costs basis)	0.5%	Percent of Implementation Costs:	0.6%

PBEEEP was made possible with funding from the U.S. Department of Energy and the MN Department of Commerce.

Findings Details

PBEEEP State Government

Building: Science and Math

FWB Number:	10154	Eco Number:	4
Site:	Southwest Minnesota State University Phase 2	Date/Time Created:	4/25/2012

Investigation Finding:	Low Efficiency Motors - Science and Math AHU-3, 4 and 7	Date Identified:	1/1/2012
Description of Finding:	AHU-3 3HP supply fan motor is estimated at 80% efficient, AHU-4 5HP supply fan motor is estimated at 80% efficient, AHU-6 5HP supply fan motor is estimated at 80% efficient, AHU-7 20HP supply fan motor is estimated at 80% efficient and R-7 10HP return fan motor is estimated at 80% efficient.		
Equipment or System(s):	AHU with heating and cooling	Finding Category:	Retrofits
Finding Type:	Retrofit - Motors		

Implementer:	Facilities Management/Contractor
Benefits:	Cost savings resulting from reduced electrical consumption.
Baseline Documentation Method:	Photographs AHU-3 Existing 3HP Supply Motor, AHU-4 Existing 5HP Supply Motor, AHU-6 Existing 5HP Supply Motor, AHU-7 Existing 20HP Supply Motor, AHU-7 Existing 10HP Supply Motor
Measure:	Install Premium Efficiency Motors - Science and Math AHU-3, 4 and 7
Recommendation for Implementation:	Replace AHU-3 3HP supply fan motor with minimum 89.% premium efficiency equivalent and replace standard V-belt with cogged type for 2% drive efficiency improvement.Replace AHU-3 return fan RF-3 standard V-belt with cogged type for 2% drive efficiency improvement. Replace AHU-4 5HP supply fan motor with minimum 89.5.% premium efficiency equivalent and replace standard V-belt with cogged type for 2% drive efficiency improvement. Replace AHU-4 return fan RF-4 standard V-belt with cogged type for 2% drive efficiency improvement. Replace AHU-6 5HP supply fan motor with minimum 89.5.% premium efficiency equivalent and replace standard V-belt with cogged type for 2% drive efficiency improvement. Replace AHU-6 return fan RF-6 standard V-belt with cogged type for 2% drive efficiency improvement. Replace AHU-7 20HP supply fan motor with minimum 93% premium efficiency equivalent and replace standard V-belt with cogged type for 2% drive efficiency improvement. Replace AHU-7 return fan RF-7 10HP supply fan motor with minimum 91.7% premium efficiency equivalent and replace standard V-belt with cogged type for 2% drive efficiency improvement.
Evidence of Implementation Method:	Photograph of installed premium efficiency motors as well as measured motor amperage draw differential before and after implementation.

Annual Electric Savings (kWh):	16,255	Peak Demand Savings (kWh):	9
Estimated Annual kWh Savings ($):	$575	Estimated Annual Demand Savings ($):	$0
Contractor Cost ($):	$4,965		
PBEEEP Provider Cost for Implementation Assistance ($):	$480		
Total Estimated Implementation Cost ($):	$5,445		

Estimated Annual Total Savings ($):	$575	Utility Co-Funding for kWh ($):	$0
Initial Simple Payback (years):	9.46	Utility Co-Funding for kW ($):	$0
Simple Payback w/ Utility Co-Funding (years):	9.46	Utility Co-Funding for therms ($):	$0
GHG Avoided in U.S. Tons (C02e):	4	Utility Co-Funding - Estimated Total ($):	$0

Current Project as Percentage of Total project			
Percent Savings (Costs basis)	0.9%	Percent of Implementation Costs:	6.5%

PBEEEP was made possible with funding from the U.S. Department of Energy and the MN Department of Commerce.

Findings Details

PBEEEP State Government

Building: Science and Math

FWB Number:	10154	Eco Number:	5
Site:	Southwest Minnesota State University Phase 2	Date/Time Created:	4/25/2012

Investigation Finding:	Faultly Control Valves - Science and Math AHU-3, 6 and 7	Date Identified:	1/1/2012
Description of Finding:	AHU-3, 6, 7 cooling valves are not functioning properly, appear to be stuck in open position.		
Equipment or System(s):	AHU with heating and cooling	Finding Category:	Maintenance Related Problems
Finding Type:	Leaky/Stuck Valve		

Implementer:	Facilities Management/JCI	Benefits:	Proper unit operation and electric savings from eliminating excess heating.
Baseline Documentation Method:	Trends showing no change in discharge temperature following trended opening of valve.		
Measure:	Replace Faulty Cooling Valve		
Recommendation for Implementation:	Replace AHU-3 3-way cooling valve with equivalently sized valve 2-way cooling valve - Existing valve is extimated at 2", to be field verified by contractor. Abandoned 3-way valve bypass line shall be capped and removed. If valve repair is determined to be less costly based on investigation of issue, option will be approved. Replace AHU-6 3-way cooling valve with equivalently sized valve 2-way cooling valve - Existing valve is extimated at 2-1/2", to be field verified by contractor. Abandoned 3-way valve bypass line shall be capped and removed. If valve repair is determined to be less costly based on investigation of issue, option will be approved. Replace AHU-7 3-way cooling valve with equivalently sized valve 2-way cooling valve - Existing valve is extimated at 3", to be field verified by contractor. Abandoned 3-way valve bypass line shall be capped and removed. If valve repair is determined to be less costly based on investigation of issue, option will be approved.		
Evidence of Implementation Method:	Trending data showing proper discharge air temperature corresponding with valve position.		

Annual Electric Savings (kWh):	31,671	Peak Demand Savings (kWh):	10
Estimated Annual kWh Savings ($):	$1,121	Estimated Annual Demand Savings ($):	$0
Contractor Cost ($):	$3,500		
PBEEEP Provider Cost for Implementation Assistance ($):	$480		
Total Estimated Implementation Cost ($):	$3,980		

Estimated Annual Total Savings ($):	$1,121	Utility Co-Funding for kWh ($):	$0
Initial Simple Payback (years):	3.55	Utility Co-Funding for kW ($):	$0
Simple Payback w/ Utility Co-Funding (years):	3.55	Utility Co-Funding for therms ($):	$0
GHG Avoided in U.S. Tons (C02e):	7	Utility Co-Funding - Estimated Total ($):	$0

Current Project as Percentage of Total project			
Percent Savings (Costs basis)	1.8%	Percent of Implementation Costs:	4.7%

PBEEEP was made possible with funding from the U.S. Department of Energy and the MN Department of Commerce.

Findings Details

PBEEEP State Government

Building: Science and Math

FWB Number:	10154	Eco Number:	6
Site:	Southwest Minnesota State University Phase 2	Date/Time Created:	4/25/2012

Investigation Finding:	Inefficient Lighting Fixtures - Science and Math Whole Building	Date Identified:	1/1/2012
Description of Finding:	A total of 949 lighting fixtures were found on-site utilizing T-12 lamps. Estimated 1914 T-12 lamps used if all fixtures were filled. RFP provided identifies 1090 fixtures to be retrofitted with new lamps.		
Equipment or System(s):	Interior Lighting	Finding Category:	Retrofits
Finding Type:	Retrofit - Efficient Lighting		

Implementer:	Facilities Management/Contractor	Benefits:	Cost savings from reduced electric consumption.
Baseline Documentation Method:	Listing of existing fixtures counts and specifications noting fixture types.		
Measure:	Install T-8 Lighting		
Recommendation for Implementation:	Replace all T-12 fixtures with lower wattage T-8 equivalents. Estimated savings based on replacement of T-12 fixture with magnetic ballast to T-8 fixture with electronic ballast with an operation schedule of 12 hours per day / 235 days/year. Wattage savings per fixture from Xcel Energy Lighting Efficiency Input Wattage Guide. RFP has been accepted calling for the replacement of lamps in 1090 individual fixtures.		
Evidence of Implementation Method:	Selected photographs of retrofitted lamps (minimum 1 per fixtures type) as well as measured building electric demand before and after during similar times and conditions.		

Annual Electric Savings (kWh):	93,622	Peak Demand Savings (kWh):	66
Estimated Annual kWh Savings ($):	$3,314	Estimated Annual Demand Savings ($):	$0
Contractor Cost ($):	$37,743		
PBEEEP Provider Cost for Implementation Assistance ($):	$0		
Total Estimated Implementation Cost ($):	$37,743		

Estimated Annual Total Savings ($):	$3,314	Utility Co-Funding for kWh ($):	$0
Initial Simple Payback (years):	11.39	Utility Co-Funding for kW ($):	$0
Simple Payback w/ Utility Co-Funding (years):	11.39	Utility Co-Funding for therms ($):	$0
GHG Avoided in U.S. Tons (C02e):	21	Utility Co-Funding - Estimated Total ($):	$0

Current Project as Percentage of Total project			
Percent Savings (Costs basis)	5.2%	Percent of Implementation Costs:	44.9%

PBEEEP was made possible with funding from the U.S. Department of Energy and the MN Department of Commerce.

Findings Details

Building: Science and Math

FWB Number:	10154	Eco Number:	7
Site:	Southwest Minnesota State University Phase 2	Date/Time Created:	4/25/2012

Investigation Finding:	Poor Damper Modulation - Science and Math AHU-4	Date Identified:	1/1/2012
Description of Finding:	OA damper modulates abrubtly resulting in fluctuating discharge air and space temperatures.		
Equipment or System(s):	AHU with heating and cooling	Finding Category:	Controls Problems
Finding Type:	Controls "hunt" and/or need Loop Tuning or separation of heating/cooling setpoints		

Implementer:	Facilities Management/JCI	Benefits:	Proper unit operation and improved space comfort.
Baseline Documentation Method:	Trends showing poor modulation of OA damper - See 'SM - AHU-4 OA Damper.PDF'		
Measure:	Loop Tuning - Science and Math AHU-4 OA Damper		
Recommendation for Implementation:	Tune damper PID loop to modulate damper in a more gradual fashion to maintain discharge air temperature similar to other building units. Exact modifications to PID loop inputs will need to be field verified and tested to determine operation. Modification of PID loop will need to occur during appropriate season to ensure modulation is occuring.		
Evidence of Implementation Method:	Trending data showing proper modulation of AHU-4 OA damper and constant DAT.		

Contractor Cost ($):	$140
PBEEEP Provider Cost for Implementation Assistance ($):	$0
Total Estimated Implementation Cost ($):	$140

Estimated Annual Total Savings ($):	$0	Utility Co-Funding for kWh ($):	$0
Initial Simple Payback (years):	0.00	Utility Co-Funding for kW ($):	$0
Simple Payback w/ Utility Co-Funding (years):	0.00	Utility Co-Funding for therms ($):	$0
GHG Avoided in U.S. Tons (C02e):	0	Utility Co-Funding - Estimated Total ($):	$0

Current Project as Percentage of Total project			
Percent Savings (Costs basis)	0.0%	Percent of Implementation Costs:	0.2%

PBEEEP was made possible with funding from the U.S. Department of Energy and the MN Department of Commerce.

Findings Summary

Building: Sweetland Hall
Site: Southwest Minnesota State University Phase 2

Eco #	Investigation Finding	Total Cost	Savings	Payback	Co-Funding	Payback Co-Funding	GHG
1	Modify Setpoints and Unoccupied Setback Temperatures - Sweetland Hall Dorm Rooms	$680	$786	0.87	$0	0.87	5
2	Excessive Heating	$35	$0	0.00	$0	0.00	0
	Total for Findings with Payback 3 years or less:	**$680**	**$786**	**0.87**	**$0**	**0.87**	**5**
	Total for all Findings:	**$715**	**$786**	**0.91**	**$0**	**0.91**	**5**

PBEEEP was made possible with funding from the U.S. Department of Energy and the MN Department of Commerce.

Findings Details

Building: Sweetland Hall

FWB Number:	10153	Eco Number:	1
Site:	Southwest Minnesota State University Phase 2	Date/Time Created:	4/24/2012

Investigation Finding:	Modify Setpoints and Unoccupied Setback Temperatures - Sweetland Hall Dorm Rooms	Date Identified:	1/1/2012
Description of Finding:	Currently room conditions appear to be 70 with a band of +/- 1F during all seasons. Additionally, unoccupied temperature setbacks are not being utilized despite rooms featuring occupancy sensor and Metasys being configured to operate as such.		
Equipment or System(s):	AHU with heating and cooling	Finding Category:	Controls (Setpoint Changes)
Finding Type:	Zone setpoint setup/setback are not implemented or are sub-optimal		

Implementer:	Facilities Management/JCI	Benefits:	Cost savings resulting from decreased hot water and chilled water demand.
Baseline Documentation Method:	Trending data showing room temperatures constantly maintaining between 69F and 71F during all seasons.		
Measure:	Modify Room Temperature Setpoints and Implement Unoccupied Setbacks - Sweetland Hall Dorms		
Recommendation for Implementation:	Contractor shall adjust local setpoint controls to 74F with a band of +/- 1F during cooling conditions and 70F with a band of +/- 1F during heating conditions for all building fan coil units. Implement unoccupied temperature setbacks of 4 degrees F during cooling and heating conditions set to operate on occupancy sensors currently in place after 15 minutes of inactivity for all fan coil units located in student rooms and study spaces. This will result in setback temperatures of 66F/78F heating and cooling which should minimally impact occupant comfort and allow for quick temperature recovery. Temperature setbacks that are currently in place in public areas such as corridors and building entry space shall remain as currently configured.		
Evidence of Implementation Method:	Trending data showing updated space temperatures and showing appropriate temperature setbacks during unoccupied conditions.		

Annual Electric Savings (kWh):	7,419	Peak Demand Savings (kWh):	2
Estimated Annual kWh Savings ($):	$263	Estimated Annual Demand Savings ($):	$0
Annual Natural Gas Savings (therms):	598	Contractor Cost ($):	$560
Estimated Annual Natural Gas Savings ($):	$523	PBEEEP Provider Cost for Implementation Assistance ($):	$120
		Total Estimated Implementation Cost ($):	$680

Estimated Annual Total Savings ($):	$786	Utility Co-Funding for kWh ($):	$0
Initial Simple Payback (years):	0.87	Utility Co-Funding for kW ($):	$0
Simple Payback w/ Utility Co-Funding (years):	0.87	Utility Co-Funding for therms ($):	$0
GHG Avoided in U.S. Tons (C02e):	5	Utility Co-Funding - Estimated Total ($):	$0

Current Project as Percentage of Total project			
Percent Savings (Costs basis)	1.2%	Percent of Implementation Costs:	0.8%

PBEEEP was made possible with funding from the U.S. Department of Energy and the MN Department of Commerce.

Findings Details

Building: Sweetland Hall

FWB Number:	10153	Eco Number:	2
Site:	Southwest Minnesota State University Phase 2	Date/Time Created:	4/24/2012

Investigation Finding:	Excessive Heating	Date Identified:	1/1/2012
Description of Finding:	Mech room calling for heat unecessarily - Setpoint of 72F is higher than standard for unoccupied space.		
Equipment or System(s):	Other	Finding Category:	Controls (Setpoint Changes)
Finding Type:	Zone setpoint setup/setback are not implemented or are sub-optimal		

Implementer:	Facilities Management/JCI	Benefits:	Cost savings resulting from decreased hot water demand.
Baseline Documentation Method:	Trending data showing mechancial room continuously calling for heat.		
Measure:	Modify Mechanical Room Temperature Setpoints		
Recommendation for Implementation:	Modify mechanical room space setpoints to 55F. Although savings from reduction cannot be shown from reduced OA conditioning the space will require reduced HW flow resulting in reduced boiler gas consumption.		
Evidence of Implementation Method:	Trending data showing updated space temperatures.		

Contractor Cost ($):	$35
PBEEEP Provider Cost for Implementation Assistance ($):	$0
Total Estimated Implementation Cost ($):	$35

Estimated Annual Total Savings ($):	$0	Utility Co-Funding for kWh ($):	$0
Initial Simple Payback (years):	0.00	Utility Co-Funding for kW ($):	$0
Simple Payback w/ Utility Co-Funding (years):	0.00	Utility Co-Funding for therms ($):	$0
GHG Avoided in U.S. Tons (C02e):	0	Utility Co-Funding - Estimated Total ($):	$0

Current Project as Percentage of Total project			
Percent Savings (Costs basis)	0.0%	Percent of Implementation Costs:	0.0%

PBEEEP was made possible with funding from the U.S. Department of Energy and the MN Department of Commerce.

PBEEEP State Government

Rev. 2.0 (12/16/2010)

10151 - Individualized Learning

This checklist is designed to be a resource and reference for Providers and PBEEEP.

Finding Category	Finding Type Number	Finding Type	Relevant Findings (if any)	Finding Location	Reason for no relevant finding	Notes
a. Equipment Scheduling and Enabling:	a.1 (1)	Time of Day enabling is excessive	No AHU Cycling	AHU-1, 2, 3, 4, 5		Units run continuously and do not cycle with load during unoccupied hours.
	a.2 (2)	Equipment is enabled regardless of need, or such enabling is excessive	No AHU Cycling	AHU-1, 2, 3, 4, 5		Units run continuously and do not cycle with load during unoccupied hours.
	a.3 (3)	Lighting is on more hours than necessary.			Investigation looked for, but did not find this issue.	
	a.4 (4)	OTHER_Equipment Scheduling/Enabling			Investigation looked for, but did not find this issue.	
b. Economizer/Outside Air Loads:	b.1 (5)	Economizer Operation – Inadequate Free Cooling (Damper failed in minimum or closed position, economizer setpoints not optimized)			Investigation looked for, but did not find this issue.	Economizer functions properly when called for.
	b.2 (6)	Over-Ventilation – Outside air damper failed in an open position. Minimum outside air fraction not set to design specifications or occupancy.			Investigation looked for, but did not find this issue.	
	b.3 (7)	OTHER_Economizer/OA Loads	Over-Ventilation	AHU-2, 3, 4, 5		Heating supply air setpoint appear to range from 60F-65F in building AHUs, to meet this temperatures OA is modulated to higher than required levels. Increase DA temp to 65F to reduce OA fraction.
c. Controls Problems:	c.1 (8)	Simultaneous Heating and Cooling is present and excessive			Investigation looked for, but did not find this issue.	
	c.2 (9)	Sensor/Thermostat needs calibration, relocation/shielding, and/or replacement			Investigation looked for, but did not find this issue.	
	c.3 (10)	Controls "hunt" and/or need Loop Tuning or separation of heating/cooling setpoints			Investigation looked for, but did not find this issue.	
	c.4 (11)	OTHER_Controls			Investigation looked for, but did not find this issue.	
d. Controls (Setpoint Changes):	d.1 (12)	Daylighting controls or occupancy sensors need optimization.				
	d.2 (13)	Zone setpoint setup/setback are not implemented or are sub-optimal.	Implement Setbacks	All		Setback to 64F heating and 80F cooling.
	d.3 (14)	Fan Speed Doesn't Vary Sufficiently	No VFDs	All		All units are constant volume.
	d.4 (15)	Pump Speed Doesn't Vary Sufficiently			Investigation looked for, but did not find this issue.	CHW booster pumps cycle on properly.
	d.5 (16)	VAV Box Minimum Flow Setpoint is higher than necessary			Investigation looked for, but did not find this issue.	Damper minimums appear to be appropriate and vary for each box.
	d.6 (17)	Other_Controls (Setpoint Changes)	Modifiy setpoints/ implement setbacks	All		Temperature setpoints can be optimized - Currently 72F for heating and cooling and most areas.
e. Controls (Reset Schedules):	e.1 (18)	HW Supply Temperature Reset is not implemented or is sub-optimal			Not Relevant	No HW on-site.
	e.2 (19)	CHW Supply Temperature Reset is not implemented or is sub-optimal			Not Relevant	No chiller on-site.
	e.3 (20)	Supply Air Temperature Reset is not implemented or is sub-optimal			Investigation looked for, but did not find this issue.	
	e.4 ( )	Supply Duct Static Pressure Reset is not implemented or is sub-optimal			Not Relevant	No VFD control.
	e.5 (21)	Condenser Water Temperature Reset is not implemented or is sub-optimal			Not Relevant	No chiller on-site.
	e.6 (22)	Other_Controls (Reset Schedules)			Investigation looked for, but did not find this issue.	
f. Equipment Efficiency Improvements / Load Reduction:	f.1 (23)	Daylighting Control needs optimization—Spaces are Over-Lit			Investigation looked for, but did not find this issue.	No daylighting.
	f.2 (24)	Pump Discharge Throttled			Investigation looked for, but did not find this issue.	CHW booster pumps cycles properly as required.
	f.3 (25)	Over-Pumping			Investigation looked for, but did not find this issue.	CHW booster pumps cycles properly as required.
	f.4 (26)	Equipment is oversized for load.			Investigation looked for, but did not find this issue.	No evidence of oversizing.
	f.5 (27)	OTHER_Equipment Efficiency/Load Reduction			Investigation looked for, but did not find this issue.	
	g.1 (28)	VFD Retrofit - Fans		All		Still being investigated - electric reheat coils and lack of zone control may result in VFD implementation being impossible.

PBEEEP State Government

Rev. 2.0 (12/16/2010)

10151 - Individualized Learning

This checklist is designed to be a resource and reference for Providers and PBEEEP.

Finding Category	Finding Type Number	Finding Type	Relevant Findings (if any)	Finding Location	Reason for no relevant finding	Notes
g. Variable Frequency Drives (VFD):	g.2 (29)	VFD Retrofit - Pumps			Not Relevant	VFD booster pump control functioning properly.
	g.3 (30)	VFD Retrofit - Motors (process)			Not Relevant	
	g.4 (31)	OTHER_VFD			Investigation looked for, but did not find this issue.	
h. Retrofits:	h.1 (32)	Retrofit - Motors	Low Efficiency Fan Motors	AHU-3, 4, 5		Existing motor efficiencies range from 80-85.5%.
	h.2 (33)	Retrofit - Chillers			Not Relevant	No chiller on-site.
	h.3 (34)	Retrofit - Air Conditioners (Air Handling Units, Packaged Unitary Equipment)			Investigation looked for, but did not find this issue.	
	h.4 (35)	Retrofit - Boilers			Not Relevant	No boiler on-site.
	h.5 (36)	Retrofit - Packaged Gas fired heating			Not Relevant	
	h.6 (37)	Retrofit - Heat Pumps			Not Relevant	
	h.7 (38)	Retrofit - Equipment (custom)			Not Relevant	
	h.8 (39)	Retrofit - Pumping distribution method			Not Relevant	
	h.9 (40)	Retrofit - Energy/Heat Recovery			Investigation looked for, but did not find this issue.	EA heat recovery likely not economical due to equipment configuration and layout.
	h.10 (41)	Retrofit - System (custom)			Not Relevant	
	h.11 (42)	Retrofit - Efficient Lighting	Replace T-12 Lighting	All		Replace all remaining T-12 light fixtures with T-8.
	h.12 (43)	Retrofit - Building Envelope			Investigation looked for, but did not find this issue.	
	h.13 (44)	Retrofit - Alternative Energy			Investigation looked for, but did not find this issue.	
	h.14 (45)	OTHER_Retrofit			Investigation looked for, but did not find this issue.	
i. Maintenance Related Problems:	i.1 (46)	Differed Maintenance from Recommended/Standard			Investigation looked for, but did not find this issue.	
	i.2 (47)	Impurity/Contamination			Investigation looked for, but did not find this issue.	
	i.3 ( )	Leaky/Stuck Damper			Investigation looked for, but did not find this issue.	
	i.4 ( )	Leaky/Stuck Valve	Replace Cooling Valve	AHU-1, 3		Valves do not operate properly, stuck open/leaky.
	i.5 (48)	OTHER_Maintenance			Investigation looked for, but did not find this issue.	
j. OTHER	j.1 (49)	OTHER			Investigation looked for, but did not find this issue.	

Investigation Checklist

PBEEEP State Government

Rev. 2.0 (12/16/2010)

10152 - Regional Event Center

This checklist is designed to be a resource and reference for Providers and PBEEEP.

Finding Category	Finding Type Number	Finding Type	Relevant Findings (if any)	Finding Location	Reason for no relevant finding	Notes
a. Equipment Scheduling and Enabling:	a.1 (1)	Time of Day enabling is excessive	Excessive FCU Operation	All Building FCUs		All fan coil units run continuously with shut off during unoccupied hours.
	a.2 (2)	Equipment is enabled regardless of need, or such enabling is excessive	Excessive FCU Operation	All Building FCUs		All fan coil units run continuously with shut off during unoccupied hours.
	a.3 (3)	Lighting is on more hours than necessary.	None		Investigation looked for, but did not find this issue.	Occupancy sensors functioning properly.
	a.4 (4)	OTHER_Equipment Scheduling/Enabling	None		Investigation looked for, but did not find this issue.	
b. Economizer/Outside Air Loads:	b.1 (5)	Economizer Operation – Inadequate Free Cooling (Damper failed in minimum or closed position, economizer setpoints not optimized)	None		Not Relevant	No economizer operation available on FCUs.
	b.2 (6)	Over-Ventilation – Outside air damper failed in an open position. Minimum outside air fraction not set to design specifications or occupancy.	None		Not Relevant	Dampers balanced to fixed value and are not adjustable.
	b.3 (7)	OTHER_Economizer/OA Loads	None		Not Relevant	
c. Controls Problems:	c.1 (8)	Simultaneous Heating and Cooling is present and excessive	None		Investigation looked for, but did not find this issue.	
	c.2 (9)	Sensor/Thermostat needs calibration, relocation/shielding, and/or replacement	None		Investigation looked for, but did not find this issue.	
	c.3 (10)	Controls "hunt" and/or need Loop Tuning or separation of heating/cooling setpoints	Seperation of Setpoints Needed	All Building FCUs		Current setpoints result in hunting and cooling/heating cycles
	c.4 (11)	OTHER_Controls	None		Not Relevant	
d. Controls (Setpoint Changes):	d.1 (12)	Daylighting controls or occupancy sensors need optimization.	None		Investigation looked for, but did not find this issue.	Occupancy sensors functioning properly.
	d.2 (13)	Zone setpoint setup/setback are not implemented or are sub-optimal.	No Setbacks	FCU-B102, A102, A101, A208		Units do not appear to be setting back properly based on trending data.
	d.3 (14)	Fan Speed Doesn't Vary Sufficiently	None		Not Relevant	No VFD Control.
	d.4 (15)	Pump Speed Doesn't Vary Sufficiently	None		Investigation looked for, but did not find this issue.	Pump speed varies properly.
	d.5 (16)	VAV Box Minimum Flow Setpoint is higher than necessary	None		Not Relevant	
	d.6 (17)	Other_Controls (Setpoint Changes)	Modify Setpoints	All Building FCUs		Setpoints are currently 70F/72F heating/cooling. Modify to 70F/74F.
e. Controls (Reset Schedules):	e.1 (18)	HW Supply Temperature Reset is not implemented or is sub-optimal	None		Not Relevant	No HW heating.
	e.2 (19)	CHW Supply Temperature Reset is not implemented or is sub-optimal	None		Not Relevant	CHW provided by central plant.
	e.3 (20)	Supply Air Temperature Reset is not implemented or is sub-optimal	None		Investigation looked for, but did not find this issue.	Supply temperature modulates and is controlled on a per-unit basis with electric heating coil.
	e.4 ( )	Supply Duct Static Pressure Reset is not implemented or is sub-optimal	None		Not Relevant	
	e.5 (21)	Condenser Water Temperature Reset is not implemented or is sub-optimal	None		Not Relevant	
	e.6 (22)	Other_Controls (Reset Schedules)	None		Not Relevant	
f. Equipment Efficiency Improvements / Load Reduction:	f.1 (23)	Daylighting Control needs optimization—Spaces are Over-Lit	None		Not Relevant	
	f.2 (24)	Pump Discharge Throttled	None		Investigation looked for, but did not find this issue.	
	f.3 (25)	Over-Pumping	None		Investigation looked for, but did not find this issue.	
	f.4 (26)	Equipment is oversized for load.	None		Investigation looked for, but did not find this issue.	
	f.5 (27)	OTHER_Equipment Efficiency/Load Reduction	None		Investigation looked for, but did not find this issue.	
	g.1 (28)	VFD Retrofit - Fans	None		Not cost-effective to investigate	

PBEEEP State Government

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10152 - Regional Event Center

This checklist is designed to be a resource and reference for Providers and PBEEEP.

Finding Category	Finding Type Number	Finding Type	Relevant Findings (if any)	Finding Location	Reason for no relevant finding	Notes
g. Variable Frequency Drives (VFD):	g.2 (29)	VFD Retrofit - Pumps	None		Not Relevant	Pumps feature VFDs and function properly as needed.
	g.3 (30)	VFD Retrofit - Motors (process)	None		Not Relevant	Newer motors do not warrant replacment.
	g.4 (31)	OTHER_VFD	None		Not Relevant	
h. Retrofits:	h.1 (32)	Retrofit - Motors	None		Not Relevant	Newer motors do not warrant replacment.
	h.2 (33)	Retrofit - Chillers	None		Not Relevant	No on-site chillers.
	h.3 (34)	Retrofit - Air Conditioners (Air Handling Units, Packaged Unitary Equipment)	None		Not Relevant	
	h.4 (35)	Retrofit - Boilers	None		Not Relevant	
	h.5 (36)	Retrofit - Packaged Gas fired heating	None		Not Relevant	
	h.6 (37)	Retrofit - Heat Pumps	None		Not Relevant	
	h.7 (38)	Retrofit - Equipment (custom)	None		Not Relevant	
	h.8 (39)	Retrofit - Pumping distribution method	None		Investigation looked for, but did not find this issue.	
	h.9 (40)	Retrofit - Energy/Heat Recovery	None		Investigation looked for, but did not find this issue.	
	h.10 (41)	Retrofit - System (custom)	None		Investigation looked for, but did not find this issue.	
	h.11 (42)	Retrofit - Efficient Lighting	None		Investigation looked for, but did not find this issue.	
	h.12 (43)	Retrofit - Building Envelope	None		Investigation looked for, but did not find this issue.	
	h.13 (44)	Retrofit - Alternative Energy	None		Investigation looked for, but did not find this issue.	
	h.14 (45)	OTHER_Retrofit	None		Investigation looked for, but did not find this issue.	
i. Maintenance Related Problems:	i.1 (46)	Differed Maintenance from Recommended/Standard	None		Investigation looked for, but did not find this issue.	
	i.2 (47)	Impurity/Contamination	None		Investigation looked for, but did not find this issue.	
	i.3 ( )	Leaky/Stuck Damper	None		Investigation looked for, but did not find this issue.	
	i.4 ( )	Leaky/Stuck Valve	None		Investigation looked for, but did not find this issue.	
	i.5 (48)	OTHER_Maintenance	Rebalance	FCU-A101, A102		FCU serves two zones for which the average temerature is used to determine demand. Zone temperures are averaging 5-10F apart.
j. OTHER	j.1 (49)	OTHER	None		Investigation looked for, but did not find this issue.	

PBEEEP State Government

Rev. 2.0 (12/16/2010)

10153 - Sweetland Hall

This checklist is designed to be a resource and reference for Providers and PBEEEP.

Finding Category	Finding Type Number	Finding Type	Relevant Findings (if any)	Finding Location	Reason for no relevant finding	Notes
a. Equipment Scheduling and Enabling:	a.1 (1)	Time of Day enabling is excessive			Not Relevant	Dorm rooms can be considered as continuously occupied.
	a.2 (2)	Equipment is enabled regardless of need, or such enabling is excessive			Not Relevant	Dorm rooms can be considered as continuously occupied.
	a.3 (3)	Lighting is on more hours than necessary.			Not Relevant	Dorm rooms can be considered as continuously occupied.
	a.4 (4)	OTHER_Equipment Scheduling/Enabling			Not Relevant	Dorm rooms can be considered as continuously occupied.
b. Economizer/Outside Air Loads:	b.1 (5)	Economizer Operation – Inadequate Free Cooling (Damper failed in minimum or closed position, economizer setpoints not optimized)			Not Relevant	Fan coil units utilized have no economizer control and are served by 100% OA heat recovery units operating as designed.
	b.2 (6)	Over-Ventilation – Outside air damper failed in an open position. Minimum outside air fraction not set to design specifications or occupancy.			Not Relevant	Fan coil units utilized have no economizer control and are served by 100% OA heat recovery units operating as designed.
	b.3 (7)	OTHER_Economizer/OA Loads			Not Relevant	Fan coil units utilized have no economizer control and are served by 100% OA heat recovery units operating as designed.
c. Controls Problems:	c.1 (8)	Simultaneous Heating and Cooling is present and excessive			Not Relevant	
	c.2 (9)	Sensor/Thermostat needs calibration, relocation/shielding, and/or replacement			Not Relevant	
	c.3 (10)	Controls "hunt" and/or need Loop Tuning or separation of heating/cooling setpoints	Some cooling/heating hunting observed	FCU-115, 225		Setpoints appear to change suddenly resulting in cooling/heating changeover and drastic valve fluctuations.
	c.4 (11)	OTHER_Controls			Not Relevant	
d. Controls (Setpoint Changes):	d.1 (12)	Daylighting controls or occupancy sensors need optimization.			Not Relevant	Occupancy sensor present in dorm bathrooms believed to be functioning properly.
	d.2 (13)	Zone setpoint setup/setback are not implemented or are sub-optimal.	No Setbacks	All		[illegible] coils serve dorm spaces a minimal setback could be implemented without causing occupant discomfort.
	d.3 (14)	Fan Speed Doesn't Vary Sufficiently			Not Relevant	No VFDs
	d.4 (15)	Pump Speed Doesn't Vary Sufficiently			Investigation looked for, but did not find this issue.	
	d.5 (16)	VAV Box Minimum Flow Setpoint is higher than necessary			Not Relevant	No VAVs
	d.6 (17)	Other_Controls (Setpoint Changes)	Modify Setpoints	All Rooms		Modify setpoints to new values.
e. Controls (Reset Schedules):	e.1 (18)	HW Supply Temperature Reset is not implemented or is sub-optimal			Investigation looked for, but did not find this issue.	Boilers functioning properly.
	e.2 (19)	CHW Supply Temperature Reset is not implemented or is sub-optimal			Not Relevant	No on-site chillers.
	e.3 (20)	Supply Air Temperature Reset is not implemented or is sub-optimal			Investigation looked for, but did not find this issue.	Discharge air temperature is reset properly.
	e.4 ( )	Supply Duct Static Pressure Reset is not implemented or is sub-optimal			Not Relevant	No VFDs.
	e.5 (21)	Condenser Water Temperature Reset is not implemented or is sub-optimal			Not Relevant	No on-site chillers.
	e.6 (22)	Other_Controls (Reset Schedules)			Investigation looked for, but did not find this issue.	
f. Equipment Efficiency Improvements / Load Reduction:	f.1 (23)	Daylighting Control needs optimization—Spaces are Over-Lit			Investigation looked for, but did not find this issue.	
	f.2 (24)	Pump Discharge Throttled			Investigation looked for, but did not find this issue.	Pumps modulate properly and are not throttled.
	f.3 (25)	Over-Pumping			Investigation looked for, but did not find this issue.	Pumps modulate properly.
	f.4 (26)	Equipment is oversized for load.			Investigation looked for, but did not find this issue.	
	f.5 (27)	OTHER_Equipment Efficiency/Load Reduction			Investigation looked for, but did not find this issue.	
	g.1 (28)	VFD Retrofit - Fans			Investigation looked for, but did not find this issue.	No large fans on-site warranting VFD control.

PBEEEP State Government

Rev. 2.0 (12/16/2010)

10153 - Sweetland Hall

This checklist is designed to be a resource and reference for Providers and PBEEEP.

Finding Category	Finding Type Number	Finding Type	Relevant Findings (if any)	Finding Location	Reason for no relevant finding	Notes
g. Variable Frequency Drives (VFD):	g.2 (29)	VFD Retrofit - Pumps			Not Relevant	VFDs in place
	g.3 (30)	VFD Retrofit - Motors (process)			Not Relevant	
	g.4 (31)	OTHER_VFD			Not Relevant	
h. Retrofits:	h.1 (32)	Retrofit - Motors			Not Relevant	New Equipment in Place
	h.2 (33)	Retrofit - Chillers			Not Relevant	New Equipment in Place
	h.3 (34)	Retrofit - Air Conditioners (Air Handling Units, Packaged Unitary Equipment)			Not Relevant	New Equipment in Place
	h.4 (35)	Retrofit - Boilers			Not Relevant	New Equipment in Place
	h.5 (36)	Retrofit - Packaged Gas fired heating			Not Relevant	New Equipment in Place
	h.6 (37)	Retrofit - Heat Pumps			Not Relevant	New Equipment in Place
	h.7 (38)	Retrofit - Equipment (custom)			Not Relevant	New Equipment in Place
	h.8 (39)	Retrofit - Pumping distribution method			Not Relevant	New Equipment in Place
	h.9 (40)	Retrofit - Energy/Heat Recovery			Not Relevant	New Equipment in Place
	h.10 (41)	Retrofit - System (custom)			Not Relevant	New Equipment in Place
	h.11 (42)	Retrofit - Efficient Lighting			Not Relevant	New Equipment in Place
	h.12 (43)	Retrofit - Building Envelope			Not Relevant	New Equipment in Place
	h.13 (44)	Retrofit - Alternative Energy			Not Relevant	New Equipment in Place
	h.14 (45)	OTHER_Retrofit			Not Relevant	New Equipment in Place
i. Maintenance Related Problems:	i.1 (46)	Differed Maintenance from Recommended/Standard			Investigation looked for, but did not find this issue.	
	i.2 (47)	Impurity/Contamination			Investigation looked for, but did not find this issue.	
	i.3 ( )	Leaky/Stuck Damper			Investigation looked for, but did not find this issue.	
	i.4 ( )	Leaky/Stuck Valve			Investigation looked for, but did not find this issue.	
	i.5 (48)	OTHER_Maintenance			Investigation looked for, but did not find this issue.	
j. OTHER	j.1 (49)	OTHER			Investigation looked for, but did not find this issue.	

Investigation Checklist

PBEEEP State Government

Rev. 2.0 (12/16/2010)

10154 - Science & Math

This checklist is designed to be a resource and reference for Providers and PBEEEP.

Finding Category	Finding Type Number	Finding Type	Relevant Findings (if any)	Finding Location	Reason for no relevant finding	Notes
a. Equipment Scheduling and Enabling:	a.1 (1)	Time of Day enabling is excessive	No AHU Cycling	AHU-3, 4, 6, 7		Units run continuously and do not cycle with load during unoccupied hours.
	a.2 (2)	Equipment is enabled regardless of need, or such enabling is excessive	No AHU Cycling	AHU-3, 4, 6, 7		Units run continuously and do not cycle with load during unoccupied hours.
	a.3 (3)	Lighting is on more hours than necessary.			Investigation looked for, but did not find this issue.	
	a.4 (4)	OTHER_Equipment Scheduling/Enabling			Investigation looked for, but did not find this issue.	
b. Economizer/Outside Air Loads:	b.1 (5)	Economizer Operation – Inadequate Free Cooling (Damper failed in minimum or closed position, economizer setpoints not optimized)	Poor Economizer Control	AHU-3, 4, 6, 7		AHU-3: OA damper remains fixed at 10% during cooling conditions when full economizer would have been suitable to condition spaces. AHU-4, 6, 7: Economizers do not operate as expected, typically remains at minimum positions.
	b.2 (6)	Over-Ventilation – Outside air damper failed in an open position. Minimum outside air fraction not set to design specifications or occupancy.			Investigation looked for, but did not find this issue.	
	b.3 (7)	OTHER_Economizer/OA Loads	Over-Ventilation	AHU-3, 4, 6, 7		Heating supply air setpoint appear to range from 55F-60F in building AHUs, to meet this temperatures OA is modulated to higher than required levels. Increase DA temp to 65F to reduce OA fraction.
c. Controls Problems:	c.1 (8)	Simultaneous Heating and Cooling is present and excessive			Investigation looked for, but did not find this issue.	
	c.2 (9)	Sensor/Thermostat needs calibration, relocation/shielding, and/or replacement			Investigation looked for, but did not find this issue.	
	c.3 (10)	Controls "hunt" and/or need Loop Tuning or separation of heating/cooling setpoints			Investigation looked for, but did not find this issue.	
	c.4 (11)	OTHER_Controls			Investigation looked for, but did not find this issue.	
d. Controls (Setpoint Changes):	d.1 (12)	Daylighting controls or occupancy sensors need optimization.				
	d.2 (13)	Zone setpoint setup/setback are not implemented or are sub-optimal.	No Zone Setbacks	All		Currently no temperature setbacks in place. Setback to 64F heating and 80F cooling.
	d.3 (14)	Fan Speed Doesn't Vary Sufficiently			Investigation looked for, but did not find this issue.	AHU-2 currently is only unit with VFD control and appears to modulate properly.
	d.4 (15)	Pump Speed Doesn't Vary Sufficiently			Investigation looked for, but did not find this issue.	Chilled water booster pumps only run if required and appear to modulate properly.
	d.5 (16)	VAV Box Minimum Flow Setpoint is higher than necessary			Investigation looked for, but did not find this issue.	
	d.6 (17)	Other_Controls (Setpoint Changes)			Investigation looked for, but did not find this issue.	
e. Controls (Reset Schedules):	e.1 (18)	HW Supply Temperature Reset is not implemented or is sub-optimal			Not Relevant	Electric heat only.
	e.2 (19)	CHW Supply Temperature Reset is not implemented or is sub-optimal			Not Relevant	No chiller on-site.
	e.3 (20)	Supply Air Temperature Reset is not implemented or is sub-optimal			Investigation looked for, but did not find this issue.	Issue is addressed in economizer/outdoor air loads.
	e.4 ( )	Supply Duct Static Pressure Reset is not implemented or is sub-optimal			Investigation looked for, but did not find this issue.	One unit only utilizes VAV control and operates properly.
	e.5 (21)	Condenser Water Temperature Reset is not implemented or is sub-optimal			Not Relevant	No chiller on-site.
	e.6 (22)	Other_Controls (Reset Schedules)			Not Relevant	
f. Equipment Efficiency Improvements / Load Reduction:	f.1 (23)	Daylighting Control needs optimization—Spaces are Over-Lit			Investigation looked for, but did not find this issue.	No daylighting control.
	f.2 (24)	Pump Discharge Throttled			Investigation looked for, but did not find this issue.	
	f.3 (25)	Over-Pumping			Investigation looked for, but did not find this issue.	
	f.4 (26)	Equipment is oversized for load.			Investigation looked for, but did not find this issue.	
	f.5 (27)	OTHER_Equipment Efficiency/Load Reduction			Investigation looked for, but did not find this issue.	

PBEEEP State Government

Rev. 2.0 (12/16/2010)

10154 - Science & Math

This checklist is designed to be a resource and reference for Providers and PBEEEP.

Finding Category	Finding Type Number	Finding Type	Relevant Findings (if any)	Finding Location	Reason for no relevant finding	Notes
g. Variable Frequency Drives (VFD):	g.1 (28)	VFD Retrofit - Fans				Still being investigated - electric reheat coils and lack of zone control may result in VFD implementation being impossible.
	g.2 (29)	VFD Retrofit - Pumps			Investigation looked for, but did not find this issue.	VFD booster pump control functioning properly.
	g.3 (30)	VFD Retrofit - Motors (process)			Not Relevant	
	g.4 (31)	OTHER_VFD			Investigation looked for, but did not find this issue.	
h. Retrofits:	h.1 (32)	Retrofit - Motors	Low Efficiency Fan Motors	AHU-3, 4, 7 Supply Fans and AHU-7 Return Fan		Existing motor efficiencies estimated at only 80% based on age.
	h.2 (33)	Retrofit - Chillers			Not Relevant	
	h.3 (34)	Retrofit - Air Conditioners (Air Handling Units, Packaged Unitary Equipment)			Investigation looked for, but did not find this issue.	
	h.4 (35)	Retrofit - Boilers			Not Relevant	
	h.5 (36)	Retrofit - Packaged Gas fired heating			Not Relevant	
	h.6 (37)	Retrofit - Heat Pumps			Not Relevant	
	h.7 (38)	Retrofit - Equipment (custom)			Investigation looked for, but did not find this issue.	
	h.8 (39)	Retrofit - Pumping distribution method			Investigation looked for, but did not find this issue.	
	h.9 (40)	Retrofit - Energy/Heat Recovery			Not cost-effective to investigate	
	h.10 (41)	Retrofit - System (custom)			Investigation looked for, but did not find this issue.	
	h.11 (42)	Retrofit - Efficient Lighting	Replace T-12 Lighting	ALL		Replace remaining T-12 ballasts and bulbs with new T-8.
	h.12 (43)	Retrofit - Building Envelope			Investigation looked for, but did not find this issue.	
	h.13 (44)	Retrofit - Alternative Energy			Investigation looked for, but did not find this issue.	
	h.14 (45)	OTHER_Retrofit			Investigation looked for, but did not find this issue.	
i. Maintenance Related Problems:	i.1 (46)	Differed Maintenance from Recommended/Standard			Investigation looked for, but did not find this issue.	
	i.2 (47)	Impurity/Contamination			Investigation looked for, but did not find this issue.	
	i.3 ( )	Leaky/Stuck Damper			Investigation looked for, but did not find this issue.	
	i.4 ( )	Leaky/Stuck Valve	Replace Cooling Valve	AHU-3, 6, 7		
	i.5 (48)	OTHER_Maintenance			Investigation looked for, but did not find this issue.	
j. OTHER	j.1 (49)	OTHER	Modify PID loop tuning for AHU-4 OA Damper	AHU-4		Tune loop to provide smoother modulation of damper

PBEEEP
State Government

Public Buildings Enhanced Energy Efficiency Program

SCREENING RESULTS FOR MnSCU - SMSU

Minnesota STATE COLLEGES & UNIVERSITIES

SOUTHWEST MINNESOTA STATE UNIVERSITY

05/20/10

Summary Table

Facility Name	Southwest Minnesota State University
Location	1501 State Street, Marshall, MN
Facility Manager	Cynthia Holm
Number of Buildings	26
Interior Square Footage	1,229,932
PBEEEP Provider	Center for Energy and Environment
Date Visited	3/29/10-4/2/10
Site Project Manager	Cynthia Holm
Annual Energy Cost	$1,078,429 (2009)
Utility Company	Western Area Power Association for Electric Great Plains Natural Gas Company for Natural Gas
Site Energy Use Index (EUI)	95.0 kBtu/sq. ft (2009)
Benchmark EUI (from B3)	143.0 kBtu/sq. ft

Recommendation:

A detailed investigation of the energy usage and energy savings opportunities of the thirteen buildings listed below totaling 787,839 interior square feet at SMSU is recommended at this time.

Building Name	State ID	Area (Square Feet)	Year Built
Bellows Academic Center	E26075S0167/1405	177,780	1967/69/05
Charter Hall	E26075S0670	55,618	1970
Commons East	E26075S5670	5,363	1970
Conference Center	E26075S5970	31,989	1970/96/05
Fine Arts	E26075S0268	57,650	1968
Founders Hall	E26075S1073	33,400	1973
HA Complex	E26075S5770	43,167	1970
Maintenance Building	E260750570	12,500	1970/07
Physical Education	E26075S0368	98,764	1968/70
Recreation Athletic Facility	E26075S1295	71,033	1995
Science & Technology	E26075S0470	70,285	1970
Social Science	E26075S1173	53,350	1973
Student Center	E26075S8073	76,940	1970/2005

SMSU Screening Overview

The goal of screening is to identify buildings where an in-depth energy investigation can be performed to identify energy saving opportunities that will generate savings with a relatively fast (1 to 5 years) and certain payback. The screening of the site was performed by AMEC Earth and Environmental (AMEC) with the assistance of the facility staff. Four days of walk-throughs were conducted on the week of 3/31/2010 and interviews with the facility staff were carried out to fully explore the status of the energy consuming equipment and its potential for recommissioning. CEE followed up and did a half-day site visit on 5/4/2010. This report is the result of the information gathered by AMEC and CEE.

The site is made up of twenty-six buildings totaling 1,229,932 interior square feet. There is a single automation system (Johnson Controls Metasys) which controls all the air handling and central plant equipment on the campus. The controls are DDC, but the actuation is mostly pneumatic. Some equipment is only monitored from the BAS. The buildings were all constructed between 1967 and 2009. There have been some major mechanical upgrades during the history of the facility but largely the equipment is original to the buildings. All of the campus is heated, but only twelve of the buildings are cooled.

The school operates year round, but with greatly reduced enrollment during the summer. The Western Area Power Association (a federal power agency that distributes hydroelectric power) provides electricity to the campus through one meter and limits the demand the campus can use. During the summer months, the limit is 5MW, and during the winter, it is 10MW. If the campus goes over the limit, they must buy demand and energy from the open market, which is more expensive than WAPA. The campus is almost entirely on electric energy, only Sweetland Hall has natural gas equipment. There are two electric meters and four natural gas meters at SMSU. None of the buildings are sub-metered or metered individually.

Mechanical Equipment Summary Table	
1	Johnson Controls Metasys 4 Automation System
29	Buildings
1,229,932	Square Feet
101	Air Handlers
225	Terminal Units
4	Chillers
2	Cooling Towers
9	Electric Hot Water Boilers
2	Natural Gas Hot Water Boilers

Reasons for Recommendations

The buildings are divided into three categories in this report: those that are recommended for energy investigation; those that were considered, but not recommended; and those that were poor candidates for investigation.

There are many factors that are part of the decision to recommend a building for investigation at SMSU, the following characteristics were important in the building selection process. The buildings recommended for investigation have:

- Large contiguous square footage
- Direct connection to the building automation system
- Mostly electric heating
- Occupancy schedules that vary in the facility

The buildings recommended for investigation are:

- Bellows Hall
- Charter
- Commons East
- Conference Center
- Fine Arts
- Founders Hall
- HA Complex
- Maintenance Building
- Physical Education
- Recreation Athletic Facility
- Science & Technology
- Social Science
- Student Center

The buildings that should be considered by SMSU for investigation are:

- Commons Central
- Commons West
- G Residence
- GM Residence
- GW Residence
- HB Residence
- HC Residence
- Individualized Learning
- Regional Event Center
- Science & Math
- Sweetland Hall

The buildings not recommended for investigation are:

- Child Care Center
- Vehicle Storage Building

Recommended for Investigation:

The thirteen buildings listed below, totaling 787,839 $ft^{2,}$ are good candidates for investigation. Each of these buildings has a large floor area, several air handling units, and is controlled by the building automation system.

Mechanical Equipment Summary Table	
1	Johnson Controls Metasys 4 Automation System
13	Buildings
787,839	Square Feet
62	Air Handlers
132	Terminal Units
4	Chillers
2	Cooling Towers
8	Electric Hot Water Boilers

Bellows Academic Center	State ID# E26075S0167/1405				
Area (sq.ft.)	177,780	Year Built	1967/69/2005	Occupancy (hrs/yr)	5,460*

HVAC Equipment

Name	Type	Size	Notes
BA-AH1	Constant Volume		In Bellows.
BA-AH2	Constant Volume		In Bellows.
BA-AH12	Face and Bypass CV		In Bellows.
BA-AH13	Constant Volume		In Bellows.
AHU-1	FBP Constant Volume		In Library. No Return Fan
AHU-2	VAV		In Library. Has 2 VAVs on BAS
AHU-3	VAV		In Library. Has 30 VAVs on BAS
AHU-4	VAV		In Library. Has 31 VAVs on BAS
AHU-5	Constant Volume		In Library. No Return Fan
AHU-6	Constant Volume		In Library. Heat Recovery Unit
Boiler1 Boiler2	Electric Boiler (2X)	210kW (2X) 20hp pumps (2X)	In Library.
EF5	Exhaust Fan		In Library.

Notes

*Bellows consists of classrooms and a library. The classrooms are open 3,240 hrs per year and the library is open 5,460 hrs/yr.

Bellows (Continued)

Points on BAS

Name	List of Points	Notes
BA-AH12	SF-S, Cooling Valve, Heating Output, DAT and setpoint, MAT, RAT, OAT, Mixed Air damper Position, Room Temperature and setpoint, Face and Bypass damper, Economizer setpoint, Occupancy	
BA-AH13	SF-S, Heating Output, DAT and setpoint, MAT, RAT, OAT, Mixed Air damper Position, Room Temperature and setpoint, Occupancy	
BA-AH1	SF-S, RF-S, EF-S, Heat Recovery Status, Cooling Valve, Heating Output, DAT and setpoint, MAT, RAT, OAT, Mixed Air damper Position, Room Temperature and setpoint, Face and Bypass damper, Economizer setpoint, Occupancy	
BA-AH2	SF-S, Cooling Valve, Heating Output, DAT and setpoint, MAT, RAT, EAT, Heat Recovery Temp, OAT, Mixed Air damper Position, Electric Duct Heat, Room Temperature and setpoint, Face and Bypass damper, Economizer setpoint, Occupancy	
AHU-1	SF-S, F&B Damper Pos, Zone Temp and setpoint	
AHU-2	SF-S and speed, EF-S and speed, DAT and setpoint, OA Damper Pos and min pos, Heating Output, Cooling Valve Pos, DSP and setpoint, MAT, RAT, Space Static and setpoint, Avg Zone Temp	
VAVs	Heating Valve Position, Flow and setpoint, Damper Position, Zone Temp and setpoint. Some has CO2 and/or Baseboard heat.	
AHU-3 AHU-4	SF-S and speed, EF-S and speed, DAT and setpoint, OA Damper Pos and min pos, Heating Output, Cooling Valve Pos, Humidification Valve Pos, DSP and setpoint, MAT, RAT, Space Static and setpoint, Zone Temp, RH and setpoint (4X)	
AHU-5	SF-S, Heating Valve Pos, Cooling Valve Pos, Reheat Valve Pos, Humidification Valve Pos, OA Damper Pos and min pos, MAT, RAT, Zone Temp and setpoint, Zone RH and setpoint,	
AHU-6	SF-S, EF-S, Heating Output, Wheel Status, DAT and setpoint, RAT, EAT, OAT, Zone Temp and setpoint, Zone RH and setpoint,	
Boiler1 Boiler2	B1-S, B2-S, HW Pump status, HWST and setpoint, HWRT, HWRT Low Limit, OAT, OA Enable Setpoint,	
CHW	CHW Pump Status and speed, Flow, CHWST, CHWRT, Heat Tape Status	
Radiation	Nine (9) zones of radiation with temp and setpoint and status	

Charter Hall State ID# E26075S0670					
Area (sq.ft.)	55,618	Year Built	1970	Occupancy (hrs/yr)	5,096

HVAC Equipment

Name	Type	Size	Notes
C-AH1	Dual Duct Constant Volume		
C-AH2	Dual Duct Constant Volume		
C-AH12	Constant Volume		
C-AH13	Constant Volume		
Boilers	Electric Boiler	240kW (2X)	Two boilers

Notes

Charter Hall consists of classrooms, two lecture halls and four computer labs.

Points on BAS

Name	List of Points	Notes
C-AH1 C-AH2	SF-S, RF-S, Heating Valve, Humidifier Valve, Cold Deck Temp and setpoint, Hot Deck Temp and setpoint, MAT, RAT, RARH, OAT, OA damper Position, Economizer setpoint, Night setback setpoint, Occupancy	2 Identical Units
C-AH3 C-AH4	SF-S, RF-S, Heating Valve, Cooling Valve, Humidifier Valve, DAT and setpoint, MAT, RAT, RARH, OAT, OA damper Position and min pos, Economizer setpoint, Night setback setpoint, Occupancy	2 Identical Units
Boilers	HW Pump Status, Electric Boiler Heat (%), HWST and setpoint, HWRT, OAT, Reset schedule	
CHW	CHWST and setpoint, CHWRT, CHW Flow, CHW Valve	

Commons East State ID# E26075S5670					
Area (sq.ft.)	5,363	Year Built	1970	Occupancy (hrs/yr)	8,760

HVAC Equipment

Name	Type	Size	Notes
AHU-1	Constant Volume		Hot Water Heat, No Cool
AHU-2	Constant Volume		Hot Water Heat, No Cool

Notes

Commons East is a place for students to get household equipment, get their mail and do laundry.

Points on BAS

Name	List of Points	Notes
AHUs	SF Status, DAT, Heating Valve Position, Room Temp	Both AHUs are identical.

Conference Center	State ID# E26075S5970				
Area (sq.ft.)	31,989	Year Built	1970/96/2005	Occupancy (hrs/yr)	5,460

HVAC Equipment

Name	**Type**	**Size**	**Notes**
AHU-1	Constant Volume		
AHU-2	Constant Volume		
AHU-3	Constant Volume		
AHU-4	Constant Volume		

Notes

The Conference Center is used for exactly what it sounds like; conferences and events.

Points on BAS

Name	**List of Points**	**Notes**
AHU-1 AHU-2 AHU-3	SF-S, Heating Output, Cooling Valve Pos, OA Damper pos and min pos, DAT and setpoint, RAT, RARH, MAT, OAT, Economizer setpoint, Zone Temp and setpoint	Three identical units
AHU-4	SF-S, Heating Output (2X), Cooling Valve Pos, OA Damper pos and min pos, DAT and setpoint, RAT, RARH, MAT, OAT, Economizer setpoint, Building Static Pressure and setpoint, In-floor Heat Valve Pos, Zone Temp and setpoint	

Fine Arts State ID# E26075S0268					
Area (sq.ft.)	57,650	Year Built	1968	Occupancy (hrs/yr)	3,900

HVAC Equipment

Name	Type	Size	Notes
FA-AH1	Dual Duct Constant Volume		
FA-AH2	Dual Duct Constant Volume		
FA-AH3	Dual Duct Constant Volume		
FA-AH4	Dual Duct Constant Volume		
FA-AH5	Dual Duct Constant Volume		
FA-AH6	Energy Recovery Unit 100%OA		
FA-AH7	Dual Duct Constant Volume		

Notes

The Fine Arts building houses the band and choir rooms, two theatres, and rehearsal rooms.

Points on BAS

Name	List of Points	Notes
FA-AH1 FA-AH2 FA-AH3 FA-AH4 FA-AH5 FA-AH7	SF-S, RF-S, OA Damper Pos and min pos, Hot Deck Temp and setpoint, Cold Deck Temp and setpoint, RAT, MAT, OAT, Economizer setpoint, Occupancy	6 Identical Units
FA-AH6	SF-S, EF1-S, EF2-S, Heat Recovery Status, Electric Duct heat Output, HR IN-T, HR OUT-T, HR Setpoint, DAT and setpoint, OAT, Occupancy	
CHW	CHWP8-S, CHW Flow, CHW Valve Pos, CHWST, CHWRT and setpoint, Heat Tape Status (2X)	

Founders Hall State ID# E26075S1073					
Area (sq.ft.)	33,400	Year Built	1973	Occupancy (hrs/yr)	2,600

HVAC Equipment

Name	Type	Size	Notes
FA-AH1	Constant Volume		
FA-AH2	Constant Volume		DX Cooling
FA-AH3	Constant Volume		

Notes

Founders Hall is the main office for the campus.

Points on BAS

Name	List of Points	Notes
FA-AH1 FA-AH3	SF-S, Cooling Valve Pos, Humidifier Valve Pos, OA Damper Pos and min pos, DAT and setpoint, RAT, RARH and setpoint, MAT, OAT, Economizer setpoint, Room Temp, Occupancy	2 Identical Units
FA-AH2	SF-S, Heating Output, DX Stage 1 and 2, Humidifier Valve Pos, OA Damper Pos and min pos, DAT and setpoint, RAT, RARH and setpoint, MAT, OAT, Economizer setpoint, Room Temp, Occupancy	
Snow Melt	Status, Circuit Status (2X)	

HA Complex State ID# E26075S5770					
Area (sq.ft.)	43,167	Year Built	1970	Occupancy (hrs/yr)	6,552*

HVAC Equipment

Name	Type	Size	Notes
HA-Fan-1	Constant Volume	30 kW Heat	
HA-Fan-2	Constant Volume	30 kW Heat	
HA-Fan-3	Constant Volume	30 kW Heat	
HA-Fan-4	Constant Volume	30 kW Heat	

Notes

This building is a residence hall with simple HVAC and no cooling.

*This building is closed over the summer, but otherwise operated 24/7.

Points on BAS

Name	List of Points	Notes
HA-Fans	SF-S, Occupied, DH-S, Stages of Heat (7), DAT, Zone Occupied and Unoccupied setpoint	4 Identical Units

Central plant in Maintenance Building State ID# E260750570					
Area (sq.ft.)	12,500	Year Built	1970/2007	Occupancy (hrs/yr)	2,340

HVAC Equipment

Name	**Type**	**Size**	**Notes**
Cooling Tower 1			Takes Care of Chiller 1
Cooling Tower 2			Takes Care of Chiller 2
Chiller 1	Centrifugal	750 Ton	Chiller 1 and 2 are in parallel. Main chillers for campus CHW Loop.
Chiller 2	Centrifugal	750 Ton	

Points on BAS

Name	**List of Points**	**Notes**
Cooling Tower 1 Cooling Tower 2	Status, CT LWT, CT EWT, CT Flow, CT Pump Status, OAT	
Chiller 1	CHLR1-S	
Chiller 2	CHLR2-S	
CHW Loop	CHWST and setpoint, CHWRT, CHW Flow, CHW Pump Status and Speed (2X), CHW-DP and setpoint, CHW System Enable Temperature, OAT, CHW Temps for all buildings	
Demand Limiting	A full list of all the HVAC equipment with their motor status building by building.	Used to manually shed demand when approaching the WAPA demand limits.

Physical Education	State ID# E26075S0368				
Area (sq.ft.)	98,764	Year Built	1968/70	Occupancy (hrs/yr)	5,460*

HVAC Equipment

Name	Type	Size	Notes
PE-AH1	Dual Duct Constant Volume		Serves Offices
PE-AH2	Constant Volume		Serves Gym
PE-AH3	Constant Volume		Serves Locker Rooms
PE-AH4	Heat Recovery CV		
PE-AH5	Constant Volume		Small unit serving Concession area
PE-AH6	Constant Volume		Serves Concession area
PE-AH7	Constant Volume		Serves Racquetball Court
PE-AH8	Constant Volume		Serves Pool
PE-AH9	Constant Volume		Serves Pool
Pool Heater	Electric Boiler	140kW	

Notes

The PE Building has a gym, a pool, and classrooms. The gym and pool area is open 5,460 hours per year, and the classrooms 3,900 hours per year.

Points on BAS

Name	List of Points	Notes
PE-AH1	SF-S, Heat Output, Cooling Valve Pos, OA Damper pos, Hot Deck Temp and setpoint, Cold Deck Temp, RAT, MAT, Occupancy, Room Temperature	
PE-AH2	SF-S, Heat Output, OA Damper pos and min pos, Economizer setpoint, DAT and setpoint, RAT, MAT, Occupancy, Room Temperature and setpoint	
PE-AH3	SF-S, Heat Output (2X), OA Damper pos and min pos, MAT and setpoint, RAT, Occupancy, Room Temperature and setpoint	
PE-AH4	SF-S, EF-S, Heat Recovery Status, DAT, RAT, EAT, HR Setpoint, Occupancy	
PE-AH5	SF-S	
PE-AH6	SF-S, Heating Output, Room Temperature and setpoint	
PE-AH7 PE-AH9	SF-S, RF-S, Heat Output, OA Damper pos and min pos, DAT and setpoint, RAT, MAT, Occupancy, Room Temperature and setpoint	
PE-AH8	SF-S, EF-S, Heat Output, DAT1, DAT2, EAT, OAT, Occupancy, Heat Recovery Pump Status, Room Temperature and setpoint, Room Humidity	
Pool Heaters	Heater Status, Pump Status, Water Temperature	

Recreation/Athletic Facility	State ID# E26075S1295				
Area (sq.ft.)	71,033	Year Built	1995	Occupancy (hrs/yr)	5,460

HVAC Equipment

Name	Type	Size	Notes
RA-AHU-1	Heat Recovery CV	1,700kW Heat	
RA-AHU-2	Constant Volume	10hp, 60kW Heat	Small unit serving one room
RA-AHU-3	Constant Volume	3hp, 15kW Heat	Small unit serving one room
RA-AHU-4	Constant Volume	7.5hp, 35kW Heat	Small unit serving one room
RA-AHU-5	Constant Volume		Small unit serving one room
RA-AHU-6	Constant Volume		Small unit serving one room
RA-AHU-7	Constant Volume		Small unit serving one room
RA-AHU-8	Constant Volume		Small unit serving one room
RA-AHU-9	Constant Volume		Small unit serving one room
RA-MAH-1	100% OA MAU	560kW Heat	

Notes

The R/A has a fitness center, weight room, and smaller group rooms.

Points on BAS

Name	List of Points	Notes
RA-AHU-1	SF1-S, SF2-S, RF-S, HR Pump Status, Heating Output, OA Damper Pos, RACO2, DAT, RAT, MAT, EAT, OAT, Outdoor Coil In Temp, Outdoor Coil Out Temp, Occupancy, Avg Room Temp, Room Temp (4X), Room Setpoint	
RA-AHU-2 RA-AHU-3 RA-AHU-4 RA-AHU-5 RA-AHU-7 RA-AHU-8	SF-S, Heat Output, Duct Heat Output, MA Damper Pos, RAT, RACO2 and setpoint, MAT, DAT, Occ, Flow and setpoint, Room Temp and setpoint, Economizer setpoint	
RA-AHU-6	SF-S, Cooling Valve Pos, Duct Heat Output, MA Damper Pos, RAT, RACO2 and setpoint, MAT, DAT, EAT, VAV Occ, VAV Flow and setpoint, Room Temp and setpoint, Economizer setpoint, CHWST, CHWRT, CHW Pump Status	
RA-AHU-9	SF-S, Cooling Valve Pos, Duct Heat Output, MA Damper Pos, RAT, RACO2 and setpoint, MAT, DAT, EAT, Occ, Flows and setpoints, Room Temp and setpoint, Economizer setpoint, CHWST, CHWRT, CHW Pump Status	
RA-MAU-1	SF1-S, HR Pump Status, Duct Heat Output, DAT and setpoint, RAT, MAT, EAT, OAT, HR Coil In and Out Temp, DSP and setpoint, Occupancy	
RA-CHW	CHW Pump-S, CHWST, CHWRT, Heat Tamp Status (3)	

Science & Technology			State ID# E26075S0470		
Area (sq.ft.)	70,285	Year Built	1970	Occupancy (hrs/yr)	3,900

HVAC Equipment

Name	Type	Size	Notes
AH1	Dual Duct Constant Volume		
AH2	Dual Duct Constant Volume	20hp	
AH4	Constant Volume		
AH5	Constant Volume	698kW Heat	
400T Chiller	Chiller – Air-Cooled	400 Ton	Part of campus CHW Loop. Not dedicated to this building, just located by it.

Notes

Science & Technology consists of classrooms and labs.

Points on BAS

Name	List of Points	Notes
AH-1	SF-S, Cooling Valve Pos, Heating Output, Humidification Valve Pos, Cold Deck Temp and setpoint, Hot Deck Temp and setpoint, RAT, MAT, OAT, Damper position and min position, Economizer Setpoint, Humidity Setpoint, Occupancy,	
AH-2	SF-S, Cooling Valve Pos, Heating Output, Return Air Heating Output, Humidification Valve Pos, Cold Deck Temp and setpoint, Hot Deck Temp and setpoint, RAT, RARH, MAT and setpoint, OAT, Damper position and min position, Economizer Setpoint, Humidity Setpoint, Occupancy	
AH-4 AH-5	SF-S, EF-S, FBP/Cooling Damper Position, Heating Output, DAT and setpoint, RAT, MAT, OAT, Damper position and min position, Economizer Setpoint, Room temperature and heating and cooling setpoints, Occupancy	
CHW	CHW Flow, CHW Valve, CHWST, CHWRT and setpoint, Heat Tape Status (2X)	
400T Chiller	Chiller Status, Chiller Full Load Amps %, Chiller Flow, Pump Status and speed, CHWST and setpoint, CHWRT, Compressor Status (4X), Condenser Fan Speed (2X), Evaporator Temp (2X), Demand Limit (%)	

Social Science State ID# E26075S1173					
Area (sq.ft.)	53,350	Year Built	1973	Occupancy (hrs/yr)	3,900

HVAC Equipment

Name	Type	Size	Notes
AH-1	VAV with Heat Recovery	16kW Heat	
AH-2	VAV	28 kW Heat	
AH-3	VAV with Heat Recovery	15 kW Heat	
CHLR1	Chiller – Air-cooled	150 Ton	Not in use.

Notes

The Social Science building has classrooms, and a small museum.

Points on BAS

Name	List of Points	Notes
AH-1 AH-3	SF-S, RF-S, Heat Recovery Status, Heat Wheel Status and Speed (Intake and Exhaust Wheels), Preheat Output (%), Heating Output (%), Cooling Valve Pos, DAT and setpoint, RAT, Preheat Temp, MAT, OAT, EAT, High Room CO2, DSP, OA Flow, Space Static Pressure, OA Damper position and min position, RA Damper Position and min position, Occupancy, Winter/Summer Switchover setpoint	
AH-2	SF-S, RF-S, Heating Output (%), Cooling Valve Pos, DAT and setpoint, RAT, MAT, OAT, EAT, RACO2, DSP, OA Flow, Space Static Pressure, OA Damper position, RA Damper Position, Occupancy, Winter/Summer Switchover setpoint	
CHLR1	Status, Water Flow, Pump control, Pump Status, CHWST, CHWRT, CHWS Pressure, CHWR Pressure,	
Chilled Water	Chiller Status, Pump Status, Compressor 1 Status, Compressor 2 Status, Pump VFD Speed, CHWST and setpoint, CHWRT, Plant CHWST, Plant CHWRT, Condenser Fan 1 Speed, Condenser Fan 2 Speed, Loop DP and setpoint, Demand Limit (%)	
CHW Heat Trace	Heat Tape Status (2X)	
CO2	All room CO2 Levels (26 Rooms)	

Student Center State ID# E26075S8073					
Area (sq.ft.)	76,940	Year Built	1970/2005	Occupancy (hrs/yr)	5,460

HVAC Equipment

Name	**Type**	**Size**	**Notes**
AHU-1	VAV	30hp, 575 kW Heat	49 VAVs
AHU-2	VAV	25hp, 175 kW Heat	18 VAVs
Boiler 1	Electric Boiler	225kW	
Boiler 2	Electric Boiler	225kW	
EX Fans			5 Units
CUHs			7 Units

Notes

The Student Center is the hub for SMSU students. It has the main dining hall, a coffee shop, book store, and various offices.

Points on BAS

Name	**List of Points**	**Notes**
AHU-1 AHU-2	SFA-S and speed, SFB-S and speed, RF-S and speed, DAT and setpoint, DSP and setpoint, Heat Output, Cooling Valve Pos, OA Damper Pos, MAT,RAT, RARH, OAT, SF-Flow, RF-Flow, Economizer Setpoint	
Boilers	System Enable, BLR1-S, BLR1-Output (%), BLR1-HWST, BLR1-HWRT, BLR2-S, BLR2-Output (%), BLR2-HWST, BLR2-HWRT, HWST and setpoint, HWRT, HW Pump 1-S, HW Pump 2-S, HW Pump 3-S, HW Pump 4-S, Floor Heat Valve Pos, Snow Melt Status,	
CHW	CHW-Enable, CHW Pump (2-4) Status, CHW Pump 5 Status and speed, CHWDP and setpoint, CHWST, CHWRT, CHW Valve(A-C) Position,	

Consider for Investigation:

There are eleven buildings, two of the commons, six dorms, Individualized Learning, Regional Event Center, and Science & Math, that should be considered for investigation by SMSU. The eleven buildings have a total of 434,799 interior square feet. While some of these buildings are large, they are currently under construction. The other buildings have a small floor area, no cooling, or little to no control on the BAS. The screening information was collected from site visits, interviews, mechanical prints, and past energy studies.

Mechanical Equipment Summary Table	
1	Johnson Controls Metasys 4 Automation System
11	Buildings
434,799	Square Feet
39	Air Handlers
93	Terminal Units
1	Electric Hot Water Boilers
2	Natural Gas Hot Water Boiler

Commons Central State ID# E26075S5168

Area (sq.ft.)	5,746	Year Built	1968	Occupancy (hrs/yr)	8,760

HVAC Equipment

- **AHU**

Name	Type	Size	Notes
AHU-1	Constant Volume	47.5 kW Heat	7 Stages of Heat, No Cool
AHU-2	Constant Volume	47.5 kW Heat	7 Stages of Heat, No Cool

Notes

This building is small and has very simple HVAC and no cooling.

Points on BAS

Name	List of Points	Notes
AHUs	SF Status, DAT, Stages of Heat (7), Room Temp, Day and Night Setback and setpoint.	Both AHUs are identical.

Commons West State ID# E26075S6170					
Area (sq.ft.)	5,363	Year Built	1970	Occupancy (hrs/yr)	8,760

HVAC Equipment

Name	Type	Size	Notes
Fan 1	Constant Volume	30 kW Heat	Serves Office. Has Electric Duct Heater
Fan 2	Constant Volume	17.5 kW Heat	Serves Lounge. Has Electric Duct Heater

Notes

This building is small and has very simple HVAC and no cooling.

Points on BAS

Name	List of Points	Notes
All	Fan 1 Status, Fan 2 Status, EDH1 Status, EDH2 Status	All were offline.

G Residence Hall State ID# E26075S5469					
Area (sq.ft.)	38,792	Year Built	1969	Occupancy (hrs/yr)	6,552*

HVAC Equipment

Name	Type	Size	Notes
G-Fan-1	Constant Volume	30 kW Heat	
G-Fan-2	Constant Volume	30 kW Heat	
G-Fan-3	Constant Volume	30 kW Heat	
G-Fan-4	Constant Volume	30 kW Heat	

Notes

This building is large but has very simple HVAC and no cooling.

*This building is closed over the summer.

Points on BAS

Name	List of Points	Notes
G-Fans	SF-S, Occupied, DH-S, Stages of Heat (7), DAT	4 Identical Units

GM Residence Hall	State ID# E26075S5268				
Area (sq.ft.)	38,478	Year Built	1968	Occupancy (hrs/yr)	6,552*

HVAC Equipment

Name	Type	Size	Notes
GM-Fan-1	Constant Volume	30 kW Heat	
GM-Fan-2	Constant Volume	30 kW Heat	
GM-Fan-3	Constant Volume	30 kW Heat	
GM-Fan-4	Constant Volume	24 kW Heat	

Notes

This building is large but has very simple HVAC and no cooling.
*This building is closed over the summer.

Points on BAS

Name	List of Points	Notes
GM-Fan-1	SF-S, Preheat-S, Heat-S, Preheat DAT, DAT, Room Temp	
GM-Fan-2-4	SF-S, Occupied, DH-S, Stages of Heat (7), DAT, Zone Occupied and Unoccupied setpoint	3 Identical Units

GW Residence Hall	State ID# E26075S5368				
Area (sq.ft.)	40,100	Year Built	1968	Occupancy (hrs/yr)	6,552*

HVAC Equipment

Name	Type	Size	Notes
GW-Fan-1	Constant Volume	63 kW Heat total	
GW-Fan-2	Constant Volume		
GW-Fan-3	Constant Volume		
GW-Fan-4	Constant Volume		

Notes

This building is large but has very simple HVAC and no cooling.
*This building is closed over the summer.

Points on BAS

Name	List of Points	Notes
GW-Fans	Occupied-S, SF-S and Speed, EF-S and Speed, Electric Heat Output (%), Zone temp, day and night setpoints, DAT, MAT	4 Identical Units

HB Residence Hall	State ID# E26075S6070				
Area (sq.ft.)	38,478	Year Built	1970	Occupancy (hrs/yr)	6,552*

HVAC Equipment

Name	Type	Size	Notes
HB-Fan-1	Constant Volume	30 kW Heat	
HB-Fan-2	Constant Volume	30 kW Heat	
HB-Fan-3	Constant Volume	30 kW Heat	
HB-Fan-4	Constant Volume	30 kW Heat	

Notes

This building is large but has very simple HVAC and no cooling.

*This building is closed over the summer.

Points on BAS

Name	List of Points	Notes
HB-Fans	SF-S, Occupied, DH-S, Stages of Heat (7), DAT, Zone Occupied and Unoccupied setpoint	4 Identical Units

HC Residence Hall	State ID# E26075S5870				
Area (sq.ft.)	39,922	Year Built	1970	Occupancy (hrs/yr)	6,552*

HVAC Equipment

Name	Type	Size	Notes
HC-Fan-1	Constant Volume	30 kW Heat	
HC-Fan-2	Constant Volume	30 kW Heat	
HC-Fan-3	Constant Volume	30 kW Heat	
HC-Fan-4	Constant Volume	30 kW Heat	

Notes

This building is large but has very simple HVAC and no cooling.

*This building is closed over the summer.

Points on BAS

Name	List of Points	Notes
HC-Fans	SF-S, Occupied, DH-S, Stages of Heat (7), DAT, Zone Occupied and Unoccupied setpoint	4 Identical Units

Individualized Learning State ID# E26075S0872					
Area (sq.ft.)	61,560	Year Built	1972	Occupancy (hrs/yr)	3,900

HVAC Equipment

Name	Type	Size	Notes
IL-AH1	Constant Volume		Duct Reheats in spaces
IL-AH2	Constant Volume		Duct Reheats in spaces
IL-AH3	Constant Volume	10hp	Duct Reheats in spaces
IL-AH4	Constant Volume	7.5hp	New fan. Duct Reheats in spaces
IL-AH5	Constant Volume	7.5hp	New fan. Duct Reheats in spaces

Notes

This building is large but the south pod is under construction, completion date in August 2010.

Points on BAS

Name	List of Points	Notes
IL-AHs	SF-S, Cooling Valve Pos, OA Damper pos and min pos, Economizer setpoint, DAT and setpoint, RAT, RARH, MAT, Occupancy,	AH1 has 4 EF-S. AH3 has 4 EF-S.
CHW	CHWP-S (3X), CHWST, CHWRT and setpoint, CHW Flow, CHW Valve Pos, Heat Tape Status (4X)	Building is divided into North, South, and East. Each has own controls.

Regional Event Center State ID# E26075S8009					
Area (sq.ft.)	24,700	Year Built	2008	Occupancy (hrs/yr)	3,640*

HVAC Equipment

Name	Type	Size	Notes
FCU	Fan Coil Unit (4-Pipe)	20 Units	HW and CHW
UH	Unit Heater	23 Units	
EF	Exhaust Fan	8 Units	
FTR	Fin Tube Radiation	2 Areas	Electric
RACU	Room AC Unit	1 Unit	

Notes

This building is large but has no BAS control. The temperatures are only monitored.

*This building is closed over the summer.

Points on BAS

Name	List of Points	Notes
Floor plans	Room temperatures, FCU, UH, EF, FTR, RACU Locations	Lower and Upper Levels
CHW	Pump-S and speed, CHWST, CHWRT, CHWDP, CHW Flow	

Science & Math	State ID# E26075S0772				
Area (sq.ft.)	74,060	Year Built	1972	Occupancy (hrs/yr)	3,900

HVAC Equipment

Name	Type	Size	Notes
AH-1	Constant Volume AHU	20hp SF, 10hp RF	Serves Animal Room
AH-2	Constant Volume AHU	20hp SF, 10hp RF	Serves 1st Floor Interior W
AH-3	Constant Volume AHU	20hp SF, 10hp RF	Serves 1st Floor Interior E
AH-4	Constant Volume AHU	20hp SF, 10hp RF	Serves Planetarium & Museum
AH-5	Constant Volume AHU	20hp SF, 10hp RF	Serves 2nd Floor Interior W
AH-6	Constant Volume AHU	20hp SF, 10hp RF	Serves 2nd Floor Interior E
AH-7	Constant Volume AHU	20hp SF, 10hp RF	Serves All Perimeter
AH-8	Constant Volume AHU		Serves Electrical Room in Basement
BLR2	Electric Boiler		Serves Greenhouse

Notes

This building is large but two new AHUs are being installed, finished in December 2010.

Points on BAS

Name	List of Points	Notes
AH-1	SF-S, RF-S, Compressor Fan Status, Condenser Fan Status, Heating Command (%), Cooling Command (%), Preheat (%), Duct Heater (%), Humidification (%), DAT, Room temperature and setpoint, Room Humidity, Preheat temp, OAT, Occupancy	
AH-2 AH-3 AH-5 AH-7	SF-S, RF-S, Cooling Valve Pos, Heating Valve Pos, Humidification Valve Pos, DAT and setpoint, RAT, RARH, MAT, OAT, Damper position and min position, Economizer Setpoint, Room temperature and setpoint, Occupancy	
AH-4 AH-6	SF-S, RF-S, Cooling Valve Pos, Humidification Valve Pos, DAT and setpoint, RAT, RARH, MAT, OAT, Damper position and min position, Economizer Setpoint, Room temperature and setpoint, Occupancy	
AH-8	SF-S, RF-S, Damper Position and min position, DAT and setpoint, Room temperature, Boiler Enable Call	
CHW-PH	Heat Tape (1-4) Status, CHW Flow Meter, CHW Valve Pos, CHWST, CHWRT and setpoint,	Chilled Water Control for AHUs in penthouse.
BLR2	Boiler-S, HWST, HWRT, East Room Temp, West Room Temp	

Sweetland Hall State ID# E26075S8010					
Area (sq.ft.)	67,600	Year Built	2009	Occupancy (hrs/yr)	8,760

HVAC Equipment

Name	**Type**	**Size**	**Notes**
HRU-1	Heat Recovery Unit		
HRU-2	Heat Recovery Unit		
FCU	4-Pipe Fan Coil Unit	47 Units	One in each living unit. Cooling and Heating coils.
Boilers	Natural Gas Boilers	1,750kBtu/h (2x)	

Notes

This building is large but not controlled by the BAS. All terminal equipment is controlled by room thermostats. The building has been in use for less than one year.

Points on BAS

Name	**List of Points**	**Notes**
HRU-1 HRU-2	SF-S, EF-S, Wheel-S, OAT, HR Temp, DAT and setpoint, EAT, Wheel Air Temp, Preheat Pump-S, Preheat Valve Pos, Cooling Valve Pos, OAD Open/Closed	
Rooms	Temperature and setpoint	

Poor Candidates for Investigation:

Two buildings, the Child Care Center and Vehicle Storage Building, totaling 7,294 ft^2 listed below are not good candidates for investigation. The screening information was collected from site visits, interviews, mechanical prints, and past energy studies. These additional attributes support the decision to recommend the facility for recommissioning:

- The remaining buildings are small (totaling 7,294 square feet)
- Not on the Building Automation System
- Residential style HVAC systems.

Child Care Center State ID# E26075S1590					
Area (sq.ft.)	2,744	Year Built	1990	Occupancy (hrs/yr)	3,120
HVAC Equipment					
• **Not on BAS**					
Points on BAS					
• **Not on BAS**					

Vehicle Storage Building State ID# E26075S1606					
Area (sq.ft.)	4,550	Year Built	2005	Occupancy (hrs/yr)	2,080
HVAC Equipment					
• **Not on BAS**					
Points on BAS					
• **Not on BAS**					

PBEEEP Abbreviation Descriptions			
AHU	Air Handling Unit	HW	Hot Water
BAS	Building Automation System	HWDP	Hot Water Differential Pressure
CDW	Condenser Water	HWRT	Hot Water Return Temperature
CDWRT	Condenser Water Return Temperature	HWST	Hot Water Supply Temperature
CDWST	Condenser Water Supply Temperature	kW	Kilowatt
CFM	Cubic Feet per Minute	kWh	Kilowatt-hour
CHW	Chilled Water	MA	Mixed Air
CHWRT	Chilled Water Return Temperature	MA Enth	Mixed Air Enthalpy
CHWDP	Chilled Water Differential Pressure	MARH	Mixed Air Relative Humidity
CHWST	Chilled Water Supply Temperature	MAT	Mixed Air Temperature
CRAC	Computer Room Air Conditioner	MAU	Make-up Air Unit
CV	Constant Volume	OA	Outside Air
DA	Discharge Air	OA Enth	Outside Air Enthalpy
DA Enth	Discharge Air Enthalpy	OARH	Outside Air Relative Humidity
DARH	Discharge Air Relative Humidity	OAT	Outside Air Temperature
DAT	Discharge Air Temperature	Occ	Occupied
DDC	Direct Digital Control	PTAC	Packaged Terminal Air Conditioner
DP	Differential Pressure	RA	Return Air
DSP	Duct Static Pressure	RA Enth	Return Air Enthalpy
DX	Direct Expansion	RARH	Return Air Relative Humidity
EA	Exhaust Air	RAT	Return Air Temperature
EAT	Exhaust Air Temperature	RF	Return Fan
Econ	Economizer	RH	Relative Humidity
EF	Exhaust Fan	RTU	Rooftop Unit
Enth	Enthalpy	-S	Status
ERU	Energy Recovery Unit	SF	Supply Fan
FCU	Fan Coil Unit	Unocc	Unoccupied
FTR	Fin Tube Radiation	VAV	Variable Air Volume
HP	Horsepower	VFD	Variable Frequency Drive
HRU	Heat Recovery Unit	VIGV	Variable Inlet Guide Vanes

Conversions:
1 kWh = 3.412 kBtu
1 Therm = 100 kBtu
1 kBtu/hr = 1 MBH